Quorum Corporation








Grain Monitoring Program
Supplemental Study

Grain Supply Chain Study

September 2014

Foreword

On March 18, 2011 the Government of Canada announced its response to the Rail Freight Service Review that was undertaken in 2008 to address the ongoing issues with rail freight service raised by users of the rail freight supply chain. The Government accepted the commercial approach recommended by the Rail Freight Service Review Panel and announced its intention to implement four key initiatives aimed at improving the performance of the Canadian rail supply chain. These included:

- establishment of a six-month facilitation process with shippers, railways and other stakeholders to negotiate a template service agreement and streamlined commercial dispute resolution process;
- introduction of a bill to give rail shippers the right to a service agreement to support the commercial measures;
- establishment of a Commodity Supply Chain Table made up of representatives from the various rail supply chain stakeholder groups to address logistical concerns and develop performance metrics to improve competitiveness; and
- An in-depth analysis of the grain supply chain to focus on issues that affect that sector and help identify potential solutions.

In December 2011 Quorum Corporation was contracted by Agriculture and Agri-Food Canada (AAFC) and Transport Canada (TC) as part of its mandate as the Grain Monitor, to undertake a supplemental program study to analyze the grain supply chain.

This report forms a summary of the state and description of the Canadian grain supply chain and provides a view of the challenges faced by the stakeholders and participants in their pursuit of selling and delivering Canadian grains into the global marketplace.

The quantitative analysis of the supply chain was performed using data from the 2009-2010 and 2010-2011 period and some analysis looks at the period post-CWB. The data for this analysis was graciously provided by both Class 1 railways, grain companies, the CWB and the Canadian Port Clearance Association. We are appreciative of their assistance in this regard.

Supporting this report are three technical documents that provide detailed discussions and descriptions of the study's body of work with a focus on the supply chains' production, marketing and logistics components. Those are:

- The Marketing and Logistics processes within the Canadian Grain Supply Chain
- The Quantitative Analysis of the Canadian Grain Supply Chain
- A Comparison of the Canadian and US Grain Supply Chains

We would like to acknowledge the support and participation given by industry stakeholders in the development of this report, without whose involvement the research and analysis found in the following pages would not have been possible. Appendix 1 provides a list of those stakeholders who supported this research and kindly gave of their time, provided input and in many cases also provided the supporting data for analysis and assessment. Quorum greatly appreciates their continued support of the Grain Monitoring Program (GMP) and other work endeavors such as this study.

Contents

Executive Summary

This study examines the grain supply chain in Canada and issues of concern to railways, shippers and rail freight users. The Canadian grain supply chain is a dynamic and complex grouping of interdependent assets and organizations linked by operational and communication processes essential for the production, marketing, sale and delivery of Canadian grain into domestic and world markets. The dynamic nature of the supply chain and its many complex processes and structures often leads to tension in the relationships between supply chain participants as they look to optimize their commercial and operational positions, potentially in ways that challenge others in the supply chain.

Canada is only one competitor in a vast global market for commodities. It must be competitive in price, quality and service reliability. Maintaining an efficient, well-functioning grain supply chain is critical to supporting Canada's economic interests.

The study was undertaken by Quorum Corporation, as part of its mandate as the Grain Monitor. It addresses a commitment made by Agriculture and Agri-Food Canada and Transport Canada to undertake an in-depth analysis of rail freight service to examine the ongoing issues and concerns of railways, shippers and rail freight users with regard to the state of rail freight service in Canada.

Background

In the past ten years, grain supply chains have undergone a number of important changes that have altered the way grain is sourced and moved in Western Canada. A consolidation of grain companies in conjunction with the consolidation of the country elevator system and supporting rail network, changes to rail / elevator infrastructure (with most elevators now on main or secondary lines), the increased length of truck haul to bring grain from the farmers' gates to country elevators, and the growth of short-line and producer car operations have changed the shape of the network that services the grain industry. A change in the overall logistics strategy to move grain has also taken place as special crops shippers (that is, those shipping lentils, peas and other pulse crops) see an increased utilization of marine containers for their products. Consequently, the number of container transloading facilities in the country and at port has also increased.

Prior to the 1990's, the Canadian Wheat Board (CWB) and the grain companies "pushed" grain into the elevator system, using it as a storage system that maintained a high volume of grain as inventory, and to assess the quality of the crop for sale. Today, grain is "pulled" into the elevator system to meet CWB and grain company sales. In simple terms, the push system could be characterized as "collect and sell" and the pull system as "sell and collect".

More particularly, grain marketers and buyers are increasingly sophisticated about the specific characteristics of grain that they buy. Market demands and opportunities have driven greater levels of distinction between the different varieties and grades of grain products. The marketing and sales strategies of the CWB and the grain companies have changed to respond to this demand. Grain in country and terminal elevators is more segregated and needs to be maintained as such throughout the movement of the grain through the supply chain. The increased diversity of grain products exhibited in the increased volume of special crops and value-added processing for special crops and oilseeds has also changed the way grain and grain products are marketed, sold and transported within and from Canada. Accordingly, the grain supply chain has grown to be not only more complex, but it has placed stresses on the system in places where they did not previously exist.

Railway operations have also changed with almost 85 per cent of regulated[1] grain travelling in multi-car blocks under incentive rates. Railways also use differential pricing to influence when and how grain is shipped. Unlike previous rate regimes, railways now adjust their freight rates throughout the year and across their network to reflect, for example, the efficiency of moving grain in larger blocks and seasonal demand. Incentive rail freight pricing is an important feature of logistics decisions.

With the diversity in crops and grain products, the logistics of the movement of Canadian grain and its products are now more diversified. The movement of grain is going beyond just hopper cars, as it includes bagged product in box cars or containers (domestic and marine), food oil in tank cars and bulk movements in containers.

All supply chains share a common foundational premise – they consist of businesses operating in an interconnected network focused on the planning and delivery of goods or services to their end customers. To improve the effectiveness of our supply chains the economic interests of the partners have to be aligned, and focused on objectives beyond short-term individual objectives. Reliable and timely information on supply, demand, capacity and performance is key to this alignment and should be shared across the supply chain.

Report Scope and Approach

The study was completed using a combination of independent research, consultation with supply chain stakeholders and quantitative analysis. The study was completed in two phases: the first involved working with industry to identify key issues; and the second comprised the research and analysis required to assess the key issues identified. The study provides an in-depth description and analysis of the grain supply chains with a focus on Western Canada. It also describes Canadian marketing systems for grains and grain products, and examines the dynamic interface between the grain handling, transportation and grain marketing systems.

Key Findings

Grain Supply Chain and Marketing Systems

The Canadian grain supply chain is vast and includes many different businesses and interconnected infrastructure, and there are aspects that differentiate it from a typical supply chain. First and foremost is the separation of those controlling the production (farmers / producers) from those who manage and control the primary marketing and selling of grain to the end use customer (grain exporters and dealers). Second is the high dependence of the Canadian grain supply chain on the rail freight logistics system to provide the necessary capacity to position grain to export position at port.

Unlike many other competing countries where production is relatively close to export tidewater, in Canada the average rail haul from inland elevator to port is about 1,500 km. Grain must be gathered via a road and rail network and delivered to ports for vessel loading throughout the year. At times, grain gathering, transportation and vessel loading activities must be conducted in the face of a harsh climate with frequent heavy rain, extreme snowfall and prolonged periods of cold temperatures.

There exists niche markets where quality attributes yield premium pricing although there is uncertainty as to whether this translates into improved margins due to the incremental supply chain costs involved in preserving these attributes through the chain. Market strategies for blending of grain to meet customer specifications require the segregation of grains in elevators either in the country or at port. Segregation activities can have inherently higher costs and therefore negative effects on the performance of the logistics system.

[1] Grain covered under Schedule 2 of the Canada Transportation Act

Seasonal shipping peaks driven by the timing of Canadian harvests and the need to compete with grain originating in competing countries at the same times throughout the year can place pressure on the logistics system in Canada. Due to the timing of harvest in competitive markets around the world, the price of grain fluctuates seasonally, with premium prices often available in the post-harvest months in Canada, increasing the demand for transportation during this period. Stakeholders in the supply chain strive to manage or control their positions in order to take advantage of market opportunities. While some may attempt to level demand peaks (as the CWB did because it had lesser relative supply risk), others look to take advantage of peak pricing opportunities. The result can often mean a conflict between stakeholders in the supply chain.

The dynamics of grain markets and grain marketing activities have changed with the removal of the Canadian Wheat Board's monopoly on the sale of wheat and barley. This has altered the way in which these grains are marketed, sold and who can sell them, and may change the nature of market development efforts in the future.

Alignment between the Marketing and Logistics components within the Supply Chain

The planning of railway resources and assets and the timely and consistent performance of the railways for the movement of grain are key to effective supply chain performance. When planning a sale, grain companies look to railways as far out as three months to confirm they will have the capacity to move the grain to port position. For medium and longer-term planning, railways depend on shippers to provide reliable demand forecasts in order to plan asset and resource allocation positioning. Changes to directional traffic flows or planned volumes can result in train crews, locomotives and maintenance staff not being available to support efficient train operations. Reallocation of these resources to respond to such changes can sometimes take months to come into effect.

When car supply in the country fails in the time period scheduled, or variability in railway transit impacts the reliable and timely delivery of cars to port, scheduling of terminal activities and vessel loading activities are impacted, which increases terminal costs, potentially results in demurrage and can result in contract penalties for the seller.

While it is accepted that car supply is dependent on the railways' ensuring adequate fleet size exists to meet demand, port grain terminals share in that responsibility as the railways can only supply cars that have been emptied at the terminal. The ongoing supply of grain to port is entirely dependent on the efficient execution of both operations within the supply chain.

Vancouver's port facilities and rail corridors en route to the port are the most vulnerable elements of Canada's supply chain (given its preference as an export gateway). There is a need for some measure of surge capacity within the system consisting of adequate resources and assets to ensure rapid recovery from disruptions (such as severe weather events) thereby allowing the supply chain to return to normal operation as quickly as possible. Labour issues, particularly at port position, can amplify the effects of performance variability of the supply chain system.

Access to rail capacity in Canada is regulated by the monopoly / duopoly structure of the rail transportation market. Under this structure, capacity allocation is not necessarily based on market mechanisms. Railways are in the position of having to allocate railcars in times of higher market demand. This can exacerbate capacity supply challenges for the shipper. At the same time, railways are focused on improving their profitability through increased asset utilization, which would spread as much volume throughout the year as possible (a practice commonly referred to as "flattening demand").

Some of the challenges faced by the supply chain can be controlled and managed, such as those related to planning and allocation of capacity and execution of service. Others, such as those related to weather or service disruptions stemming from infrastructure failure must be managed with efforts directed at returning service to normal operations in as timely and as effective a manner as possible. The unpredictable timing of weather events and operational or market disruptions requires flexibility within the Grain Handling and Transportation System (GHTS) to afford the system the ability to respond.

Container shipping logistics also suffer from challenges in optimizing flow and providing incentives for responsible asset use. Generally, there are no direct financial consequences to shippers for failing to utilize a container booking and there are no direct consequences to shipping lines for failing to provide a container against a booking. This can result in periodic congestion at transload facilities due to a combination of bunching of traffic in transit to transloaders and shipments being directed to transloaders without either terminal authorization or valid container bookings.

Systems and processes for reservations for gate appointments at Vancouver port container terminals are not necessarily efficient. Block reservations made without accurate booking references will often allow carriers to pick-up more containers than are required, which leads to shortages for operators with legitimate requests. The approach to making reservations places burdens on drayage operators and encourages gaming the system. Specifically, this refers to the "draw" approach to obtaining a reservation and encourages truckers to make multiple "phantom" reservations in order to ensure they get a slot in the terminal queue.

Communication and cooperation between stakeholders in the supply chain is a necessary feature for sound decision-making that ensures fluidity and the ability of the sellers of grain to execute delivery on their sales. Risk assessment, contingency planning, and timely execution within the supply chain are also important to its success.

Opportunities

Canadian grain supply chains will always be challenged due to the natural variability of crop production, the limited relative capacity of the system, dynamic nature of commodity markets, and Canada's vast geography and extreme and unpredictable climate. However, there are many feasible opportunities to improve the effectiveness and reliability of Canada's grain supply chain. The study team, in conjunction with supply chain stakeholders identified the following three areas of opportunity:

1. Visibility and Transparency
2. Capacity and Reliability
3. Balanced Accountability

Visibility and Transparency

Improving the visibility and transparency of the Canadian grain supply chain would empower supply chain members to optimize their transportation and logistics strategies by proactively identifying potential or current bottlenecks in the systems and planning their operations accordingly. Improved performance measures and supply chain processes would support more accurate forward planning and provide early indications of when and where the supply chain may be weakening.

Information on rail car supply and demand, rail capacity, port capacity, vessel line-up and arrival, and weekly sales and stocks would improve supply chain efficiency through the reduction in penalties for missed arrival dates, and in the potential for overselling. It would also support more efficient scheduling of off-shift labour, optimizing the performance possible through collective agreements with labour. An improved process for communicating and utilizing sales and volume forecasts between shippers and railways would also help to enhance Canada's reputation for reliability in world markets.

An improved communications process between railways and shippers with regard to rail car supply, allocation and spotting times would enhance the shippers' ability to optimally plan and execute their logistical activities. Improvements to terminal authorization processes could ensure that no traffic is shipped to port terminals without a corresponding sale and vessel commitment. Improvements to the container booking process would reduce the number of vessels departing "light" due to no shows on confirmed bookings, containers not being available for shippers with valid bookings and the over booking of container space by shipping lines. Improvements in port reservation systems and processes for gate appointments at Vancouver port container terminals would ensure the allocation of reservations to users with legitimate container bookings.

Capacity and Reliability

Opportunities exist for the Grain Handling Transportation System (GHTS) to increase its capacity and subsequently improve its overall reliability and recoverability. With better transparency and predictability of system capacity, shippers and port terminal operators will be able to pursue more effective strategies to exchange trading positions and pursue mutually beneficial asset utilization during periods of disruption. Continued investment in strategies to mitigate predictable and controllable events (such as the implementation of rain covers for vessel loading on the west coast) will improve the reliability of the supply chain. Ongoing investment in the expansion of terminals and the adjacent improvements in both road and rail access to terminal facilities at the Port of Vancouver will also help in expanding the capacity of the system.

Balanced Accountability

Opportunities exist to improve the balance of accountability for supply chain performance between supply chain participants – specifically those who provide a service and those who use that service. A framework of penalties and incentives that applies equally to all participants across the supply chain would encourage efficient use of capacity, and help to offset the financial impacts caused when established commitments are not met.

Railways can charge shippers demurrage fees on the detention of rolling stock beyond the free time allowed for loading or unloading. These fees are intended to penalize inefficient activities beyond the rail carrier's control, and they are paid directly to the rail companies.

Balanced accountability across the supply chain would see compensation paid to offset the financial impact of inefficient activities, whether on the side of supply chain providers or users. It would encourage all participants to strive for optimal performance of the system.

Introduction

The Canadian grain supply chain is a dynamic and complex grouping of interdependent assets and organizations linked by operational and communication processes essential for the production, marketing, sale and delivery of Canadian grain into domestic and world markets. The dynamic nature of the supply chain, its many processes and complex structure often leads to tension in the relationships between the supply chain participants as they look to optimize their commercial and operational position. Canada is only one competitor in a vast global market for commodities. It must be competitive in price, quality and service reliability. Maintaining an efficient, well-functioning grain supply chain is critical to supporting Canada's economic interests.

In 2008 the Federal Government undertook a comprehensive review and assessment examining the ongoing issues and concerns of shippers and rail freight users with regard to the state of rail freight service in Canada. In its response to the review the Government committed to undertake an in-depth analysis of the grain supply chain to focus on issues that affect that sector and help identify potential solutions.

In December 2011, Quorum Corporation was asked by Agriculture and Agri-Food Canada (AAFC) and Transport Canada (TC) as part of its mandate as the Grain Monitor, to undertake a supplemental program study to analyze the grain supply chain. The findings of this undertaking are encompassed in this report.

In its Terms of Reference, the Government identified four principal objectives for the study that are summarized below.

1. To describe and analyze Canadian grain supply chain systems that market and move Canadian grain to fulfill customer demand.
2. To describe and analyze Canadian grain marketing systems.
3. To analyze the interrelationships between the logistics and marketing systems within the Canadian grain supply chain.
4. To identify opportunities for supply chain improvements

Scope and Approach

The study provides an in-depth description and analysis of the grain supply chains with a focus on Western Canada. It also describes Canadian marketing systems for grains and grain products, and examines the dynamic interface between the grain handling, transportation and grain marketing systems. Individual crops have been grouped into six categories based on their supply chain and market attributes: Barley, Pulses and Special Crops; Oilseeds; Processed Grains; Wheat and Durum; and other grains.

For this study, extensive discussions with industry stakeholders were undertaken, including both Canadian Class 1 railways and all major grain companies in order to allow for a description of the processes depicted in this study. In addition, supporting data from the Grain Monitoring program was used to help describe and support these discussions.

The study has three supporting technical documents:

- The first provides a technical description of the processes involved in the marketing and logistics components of the grain supply chain. This includes a description of the structure of markets; the factors upon which Canadian grains and grain products compete in global markets; transactional sales processes and aspects of marketing and sales activities that can introduce risk to supply chain

operations; production and volume flows; and the factors influencing producer production choices; the key players, principal transportation modes, and the logistics systems that support Canada's grain supply chains. It also includes a description of order fulfillment processes for bulk and containerized grain movements.

- The second is a quantitative analysis of the supply chain performance and background collected as part of the study including the methodology used for undertaking the study.

- The third is a comparison of the US and Canadian grain supply chains.

Project Methodology of Supply Chain Performance

The study was completed using a combination of independent research, qualitative research undertaken as part of consultations with supply chain stakeholders and a quantitative analysis using data secured from stakeholders. The approach to the study was undertaken in two phases, the first being a definitive report on the current status of the grain supply chain. This second phase, which included extensive consultation with stakeholders, identified the critical issues which served to shape the quantitative analysis. The second phase of the study also included further research and consultative sessions with stakeholders, as well as the gathering and assessment of the data used to assess supply chain performance in those areas identified by stakeholders in Phase 1.

Phase 1:

Supply Chain Process Definitions and Research undertaken

Phase 1 work began with the development and creation of process maps illustrating the major activities and information flows between stakeholders required to move grain through the various types of Canadian grain supply chains.[2] These maps, which were developed with considerable stakeholder input, provided a common understanding of how the major supply chain processes work and helped in the identification of critical points in the system. The processes mapped included: country sourcing of grain, rail hopper car demand, rail transportation and port activities (in general) and for the Port of Thunder Bay and the St. Lawrence Seaway specifically[3]. Separate maps were also provided for processed canola and for grain that moves in domestic and ocean containers.

In order to define and describe Canada's supply chain, it was also necessary to gather detailed data of Canadian grain production and movements to domestic and international markets. This formed the basis of descriptions of Canada's grain industry and its place in the global grain trade.

Stakeholder Consultations

The first phase of consultations consisted of both bilateral and group discussions designed to identify market, commercial and logistics issues and problems currently impacting supply chains and that may impact future performance.

With respect to marketing issues, bilateral discussions were held with thirteen organizations including the CWB, grain handling companies, specialty crop processors, non-asset owning grain marketers, industry associations and domestic grain purchasers. These organizations were selected with the objective of obtaining representation from stakeholders involved in marketing and sales activities for all major grain

[2] The process maps can be found in the Marketing and Logistics Technical Report.
[3] Western Canadian grain follows two major flows – east and west. The western flow moves export traffic through the ports of Vancouver and Prince Rupert while the eastern flow moves by rail to either Thunder Bay – where it is loaded to either a lake vessel for handling further down the St Lawrence Seaway - or by rail direct to eastern Canadian port elevators.

groups and to ensure that the views presented in the interviews would be generally representative of the Canadian grain industry as a whole.

These consultations were designed to explore key issues with respect to the marketing activities and capabilities of the Canadian grain industry and to identify the potential challenges and opportunities for Canada's wheat and barley supply chains following the removal of the CWB's monopoly in these markets effective August 1, 2012. These consultations were completed over a two month period during January – February 2012.

Consultations with respect to the logistics issues in the supply chain were conducted through three separate working groups: bulk domestic and export grain, containerized exports, and producers.[4] In selecting the participants for these consultative working group sessions, care was taken to make certain that as broad a spectrum of representation was found while ensuring that the size of each group did not become unwieldy.

Stakeholder Group	Number of Participating Organizations	Industry Coverage
Class 1 and Short line Railways	4	98%: Both Class 1 railways; and 2 of 15 shortlines
Grain Companies & Processors	18	92%: All major grain companies and ITAC members
Transload Operators	4	60%: all major transloaders in Vancouver and Montreal
Shipping Lines & Terminals	5	40%: Representation from major shipping lines, all port container terminals in Vancouver, Port Authority in Montreal
Regulatory Agencies	1	CGC
Producers	6	All provincial producer associations, 2 commodity associations
Industry Associations	2	Two major industry organizations were consulted
Provincial Ministries	6	All Western provinces were covered
Ports and Port Authorities	7	All major ports were consulted
Total	**53**	

Table 1 - Organizational groups in the study's consultative process

Phase 2

Stakeholder Consultations

A second round of bilateral consultations involving 23 private and public sector organizations was completed during the June – August 2012 period (See Appendix 1). Discussions with grain companies and railways focused on assessing the impact of changes to the CWB's role in areas of network management, system access and capacity and the future roles of short line railways, producer cars and the Ports of Churchill and Thunder Bay in Canadian grain supply chains going forward. With government and port stakeholders these sessions were designed to communicate preliminary study findings and solicit their views on current and potential future supply chain issues.

Bilateral consultations were also held with grain industry representatives as part of the comparison of Canadian and US grain supply chain systems. A detailed description of the US system can be found in the US Canada Supply Chain Comparison Technical Report associated to this study.

Quantitative Analysis of Supply Chain Performance

The quantitative analysis of supply chain performance was guided by the issues identified by stakeholders during consultations and the availability of data from individual stakeholders. While it would have been desirable to conduct a comprehensive analysis of all grain supply chain corridors; time, resource, data and financial constraints dictated that the analysis would be focused on the export corridor where the most

[4] Additional detail on the stakeholder consultations including the list of interviewees and interview guides are included in Quantitative Analysis Technical Report.

significant constraints were identified. As a result, the quantitative analysis focuses on the movement of grains to and through the Port of Vancouver during the 2009-10 and the 2010-11 grain year study period.[5]

Other Research Undertaken

In addition to the above analysis, the study team conducted independent research and analysis into:

- Canadian and US grain production and trade;
- Transportation and grain handling infrastructure and flows for Canadian and US grain movements; and
- Canadian and US regulations governing the production, storage, classification, inspection, grading and transportation of grains and grain products destined to both domestic and export markets.[6]

Lastly, the study team has used its extensive experience and knowledge of Canada's grain handling and transportation system and supply chain logistics obtained over the past 13 years as Canada's Grain Monitor, as well as the use of the Grain Monitoring Program's data to analyze and assess the issues raised by stakeholders to identify potential challenges, opportunities and solutions for the future performance of Canada's grain supply chains.

Throughout this report there are several acronyms and industry references used. For those who are not familiar with these references a glossary of terms and acronyms can be found in Appendix 2 of this report.

[5] A detailed description of the quantitative methodology is included the Quantitative Analysis Technical Report associated with this study.

[6] The following data sources have been used in this analysis: Quorum Corporation: Grain Monitoring Reports, Statistics Canada – Field Crop Reporting Series: Statistics Canada – Canadian International Trade Merchandise Database: US Department of Agriculture – Production, Supply and Distribution, United Nations Food and Agriculture Organization – FAO Agriculture Statistics

Overview of the Canadian Grain Sector

In 2011 there were just over 200,000 farms in Canada of which approximately 46% (or more than 95,000 farms) were primarily engaged in field crop production.[7] These farms and the producers who operate them constitute the foundation of the Canadian grains, oilseeds and special crops industries. With an annual value of $26 billion, crop production accounts for just over 50% of total Canadian farm cash receipts.[8] The production of cereals, oilseeds, special crops and corn represent $19.5 billion or 75% of annual farm cash receipts derived from crop production.

Grain is grown across a vast geographic area in Canada. 58 % of farms producing field crops are located in the Prairie Provinces where cereal, oilseed and special crop production dominates and represents 92% of total crop cash receipts in these provinces. In Quebec and Ontario corn and soybean production is most significant accounting for 42% of total crop cash receipts in those provinces. Revenues from oilseeds and grain farming are growing. As shown in Table 2, in 2011 33% of farm operators earned more than $250,000 in annual revenue as compared to only 23% five years prior.[9]

Table 2: Oilseed and Grain Farm Revenues

Revenue Class	2006 Percentage	2011 Percentage	Change
$10,000 to $49,900	33.7	26.3	-7.4
$50,000 to $99,900	18.3	17.1	-1.2
$100,000 to $249,900	24.7	23.4	-1.3
$250,000 to $499,900	14.2	15.8	+1.6
$500,000 and over	9.1	17.4	+8.3

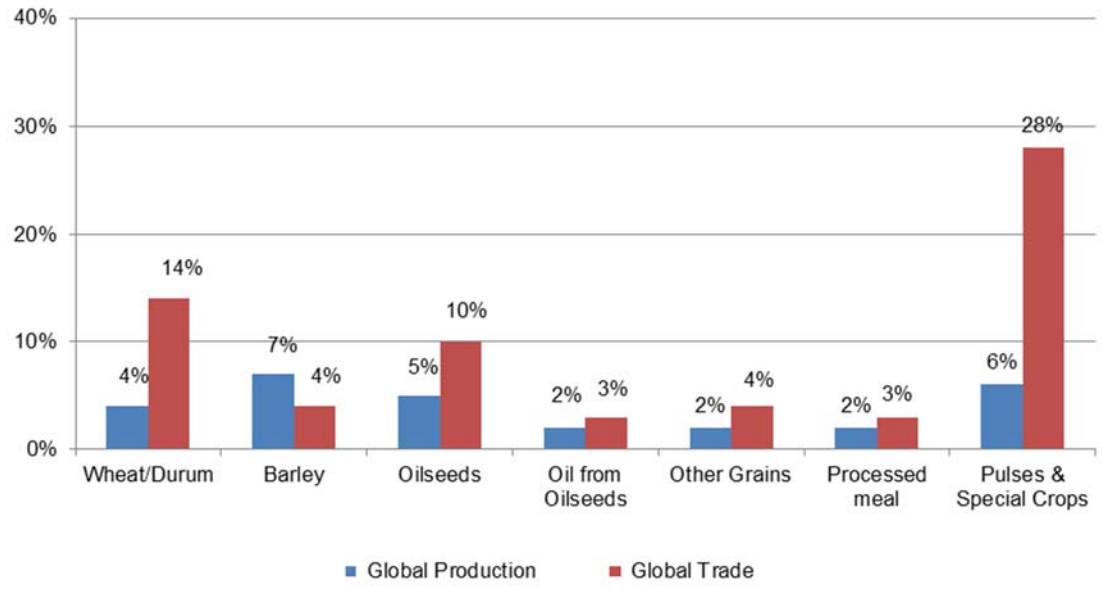
There are currently 27 million hectares[10] of seeded farmland[11] in Canada producing some 81.5 million tonnes of grains and oilseeds for domestic consumption and export to foreign markets.[12] Whereas total seeded acreage is nearly identical to that of twenty years ago total crop production in this time period has increased by 21 million tonnes or nearly 35% and the profile of both seeded acreage and crop production has changed dramatically. Driven by changing global market demand for individual crops and attractive returns for producers the amount of Canadian farm land used to grow oilseeds and specialty crops has grown significantly during the last twenty years concurrent with a decline in wheat and barley production.

The Canadian grain industry trades in the global market place where many of our major competitors have significant market and logistical advantages. There are approximately 161 countries in the world that produce a total of 2.2 billion tonnes of grain and grain products annually. Of this roughly 20% or 439 million tonnes is traded globally. [13] Canada, with annual production of 75 million tonnes and exports of 37 million tonnes, is

[7] Statistics Canada, 2011 Census of Agriculture.
[8] Statistics Canada, Table 1-30, Farm cash receipts — Agriculture economic statistics — 2010.
[9] Source: Statistics Canada.
[10] Source: "Field Crop Reporting Series", Catalogue 22-002, Statistics Canada, Area of Crops Seeded, Canada 2010-2011.
[11] Total excludes 25 million hectares of land used in the production of other crops including tame hay, fodder corn and mixed grains and approximately 15 million hectares lying fallow.
[12] Production statistics for grain year 2011-2012.
[13] Average production and export volumes for grains and grain products for the years 2005-2009 as reported by the US Department of Agriculture.

the 8th largest producing country and 4th largest exporting country in the world. Canadian grain exports represent approximately 8.5% of the global grain trade. (See Figure 1)

Figure 1: Canadian Share of Global Production and Trade - Five Year Average (2006-10)



Canada's relative position in global production and trade varies across different commodity groups. While Canada does not represent more than 7% of global production for any commodity, it does represent a significant percentage of global trade in wheat/durum, oilseeds and pulses and special crops. With the exception of oilseed production, Canada ranks among the top ten nations globally for the production and export of all commodity groups (see Appendix 3). The relevance of this for the Canadian grain industry is that Canada is only one competitor in a vast global market for commodities.

Canadian Grain Trends

Over the past two decades, there has been considerable diversification away from cereal grains and grain products to oilseed and special crops. In 2011, for example, oilseed and pulse products accounted for roughly one-quarter of the value of all Canadian agriculture and agri-food exports, compared to nearly half of that in 1998. Further, the total area planted to wheat and other grains continued to decline between 2006 and 2011 from almost 50% to under 45%.

During the early 1990s wheat, durum and barley, the so called CWB grains, accounted for 64% of Canadian seeded acreage and 72% of total crop production. By 2011 these crops had declined by a third representing only 44% of seeded acreage and 50% of total Canadian production. By comparison the production of oilseeds and specialty crops has more than tripled during this same time period going from 11% to 39% of Canadian production.

Changes in Canadian crop production can be seen not only in what is being grown but where it is being grown. Since 1991, crop production on the Prairies has grown by approximately 6% in total from 49 to 52.1 million tonnes annually.[14] Coincident with this relatively flat growth there has been a significant shift in the

[14] A three year average of production reflecting the 2008/10 to 2011/12 period is used to adjust for abnormally low crop production in Saskatchewan in 2010/11 due to unusual weather conditions.

mix of crops grown in this region with wheat and barley production declining by some 11 million tonnes (28%). This decline has been more than offset by growth in oilseeds (canola) and specialty crops whose volumes have grown by nearly 300% during the same period.

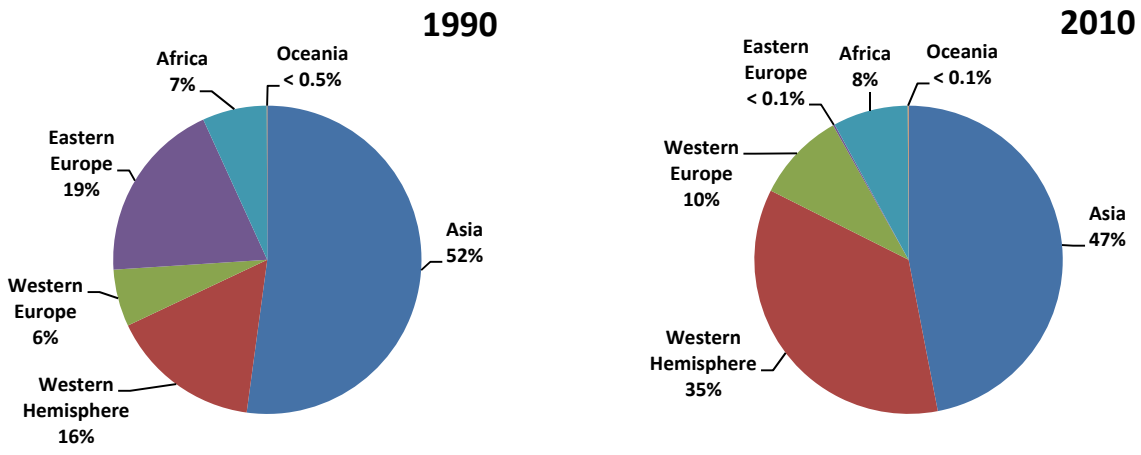
By comparison, crop production in Quebec and Ontario during this time period has grown by more than 150% or 17 million tonnes fuelled by growth in corn and oilseed (soybean) production. This has resulted in an increase in the eastern provinces' share of national production from 18% to 34% while the Prairie Provinces have experienced a commensurate decline from 82% in 1991 to 66% in 2011.

As the mix of grains and grain products produced and exported from Canada has changed so have the markets in which they are sold, as shown in Figure 2. Significant changes in Canadian export markets during the last twenty years include:

- The continuation of Asia as Canada's largest and most important export market (however, within this market, the decline of China and Japan as principal consumers of Canadian wheat and barley has been concurrent with the growth of demand for specialty crops in Indian subcontinent countries).
- The emergence of North and South American countries – including the US, Mexico and Venezuela – as Canada's fastest growing markets fuelled by growth in wheat, oilseeds and processed grain products.
- The relative decline in importance of the European market, which is directly related to the decline in wheat and barley sales.
- Changes in planting decisions with respect to durum and feed wheat as a result of altered market signals in the post-CWB environment.
- Changes in contracting, delivery and risk management options available to wheat and barley producers since August 1, 2012.

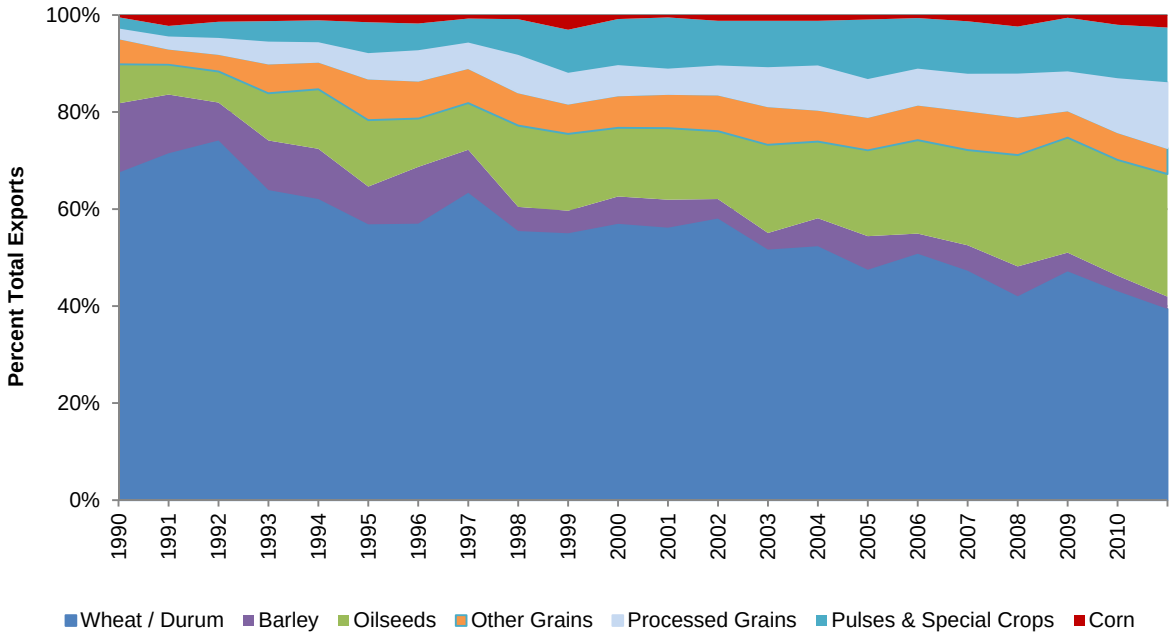
A more detailed discussion of export markets by region can be found in Appendix 3 of this report.

Figure 2: Total Canadian Grain and Grain Product Exports - 1990 vs 2010



Canadian farmers have shifted their crop production away from cereal grains to oilseeds, pulses and specialty crops in response to market demand and to take advantage of the returns available from the production of these crops. (See Figure 3) The nature and extent of this shift can be seen in the shifting export patterns for Canadian grains which have grown by some 60% from 27 to 42 million tonnes since 1990.[15]

Figure 3: Total Canadian Grain and Grain Product Exports (1990-2010)



Grain Flows and Modal Distribution

The following section provides an introduction to the structure of the major supply chains for Canadian grain products, including the primary modes of transportation used and principal modal flows to consuming markets.

Canada's grain supply chains are involved in the marketing, sale and movement of a diverse number of grains and grain products to serve domestic and international markets. Key supply chains include:

- Wheat exports to European, North American and Asia Pacific markets that use either direct rail or move through the ports of Vancouver and Prince Rupert on Canada's west coast or through the St. Lawrence Seaway using a combination of the Port of Thunder Bay and eastern Canadian transfer elevators.

- Pulse and special crops exports destined principally to markets in the Indian sub-continent and Western Asia. This supply chain is heavily dependent on the multi-modal logistics system involving a combination of railcar and container movements to the Ports of Vancouver and Montreal for transloading into ocean containers for movement to final destination.

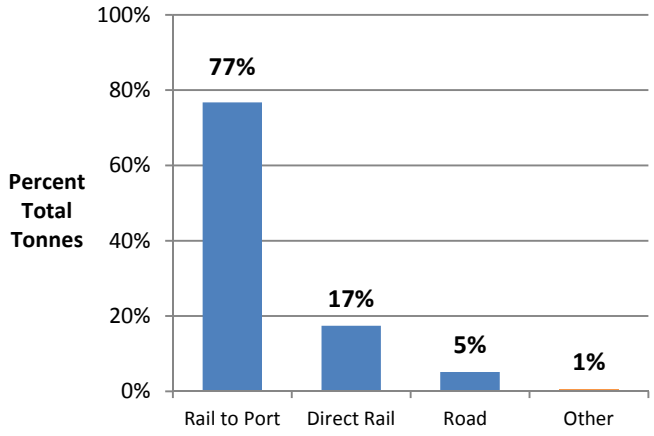
[15] Source: Statistics Canada, Canadian International Trade Merchandise Database.

- Oilseeds and oilseed products exports to China, Japan and the US.
- Export movement of other grains, including oats to the US, to meet demand for feed and flax to European and Asian markets.
- Wheat and barley movements to markets within Canada to meet the demand of the milling and malting industries.

Modal Flows

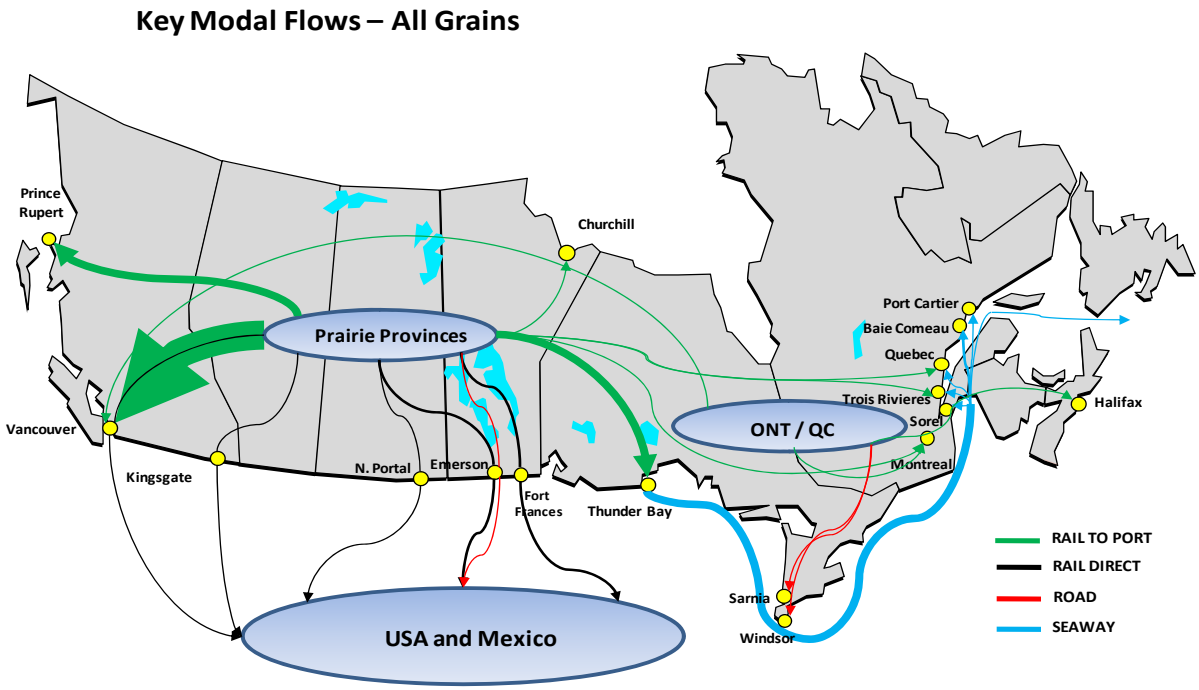
Canadian grain and grain product exports leave the country in one of three ways: by water in either bulk vessels or containers, directly by rail or by truck.

Figure 4: Modal Distribution of Canadian Grain Exports



As we can see in Figure 4, adjacent, fully 94% of all grain export traffic uses rail transportation either for movement to port for furtherance by vessel or directly to final destination in the US and Mexico (77% to port, 17% to US/ Mexico). As is shown in Figure 4 above rail transportation to export port represents more than 80% of movements in all commodity groups other than processed grains, other grains (primarily oats) and corn. For these commodity groups, rail transportation to final destination is the most important type of movement reflecting the significance of the US and Mexican markets for these commodities – approximately 5 million tonnes in 2011. Truck movements are also an important transportation mode for corn exports to the US which originate primarily in Eastern Canada. Figure 5 below provides a high level view of the modal distribution of export flows.

Figure 5: Modal Distribution of Canadian Grain Exports - 2011



The movement between the Prairie Provinces and Vancouver is the single largest corridor for export grain with a total of 18 million tonnes moving by rail in 2011 – 95% of which was exported through the Port of Vancouver with the balance moving by rail into the US. This traffic consists mostly (65%) of wheat and oilseeds with processed grains and specialty crops accounting for another 30%.

The next two largest corridors at approximately 4.5 million tonnes each are the Prairie to Prince Rupert and Prairie to Thunder Bay / Seaway corridors. In 2011 traffic to Prince Rupert consisted of wheat (70%), canola (20%) and barley (8%). Of the 4.5 million tonnes that move by rail to Thunder Bay approximately 20% is exported directly from Thunder Bay with the remaining 80% (3.6 million tonnes) moving by vessel through the Seaway to transfer elevators in Quebec.

Direct rail movement to the US and Mexico in 2011 totaled 7.1 million tonnes of which 4.8 million tonnes (67%) consisted of processed grains and oats traffic and 1.8 million tonnes being wheat and barley. Traffic railed into the US and Mexico moves through four principal gateways in British Columbia, Saskatchewan and Manitoba as shown in the Figure 5 above.

Regulatory Framework

There is a regulatory environment in place that governs the practices and protects the interests of all supply chain participants including producers, grain companies, railways, exporters and ultimately the purchasers of Canadian grain. Regulation also governs grain quality and safety, and international agreements. Up until August 2012, legislation also existed to maintain the Canadian Wheat Board as the sole marketer of wheat, durum and barley grown in Western Canada. This section examines the regulatory framework that supports the grain supply chain and marketing systems.

Transportation of Western Grain

During the last century railway freight rates have evolved from the statutory Crow's Nest Pass Rates (1897-1983) to cost based government subsidized rates under the *Western Grain Transportation Act* (WGTA)[16] (1983-1995), to a mileage-based maximum rate scale (1995-2000), and finally to the current maximum revenue entitlement regime implemented through amendments to the *Canada Transportation Act* (CTA) in 2001.[17]

Changes in government regulations over time have been driven by a variety of macro-economic, financial and international trade issues. The replacement of the Crow Rates by the WGTA in 1983 was prompted by the accelerating deterioration of the grain transportation system due to a lack of railway investment resulting from the non-compensatory nature of these rates. By 1995 pressure for federal fiscal reform combined with new World Trade Organization rules targeting direct government subsidies prompted the repeal of the WGTA and the elimination of direct government transportation subsidies. In conjunction with the repeal of the WGTA the federal government passed the Canada Transportation Act in 1996. The CTA established a mileage-based set of maximum freight rates to be paid directly by farmers.

During the winter of 1996-1997 the grain industry experienced significant issues with rail service, which resulted in a 'level of service complaint' being filed by the Canadian Wheat Board against Canadian National (CN) and Canadian Pacific (CP) railways. As a consequence, in 1997, former Supreme Court Justice Willard

[16] The Western Grain Transportation Act was enacted in 1983 based on the recommendations of the federally appointed Gilson Commission. The legislation established cost based freight rates established through quadrennial costing reviews. These rates were paid in part by producers and in part by government in the form of a direct subsidy to railways and provided for an increase in rail freight rates for grain to support investment in the rail transportation system. The WGTA rate structure replaced the statutory Crow's Nest Pass rates that had been in place 1897.

[17] A detailed description of the *Canada Transportation Act* provisions related to the grain supply chain is included in the Marketing and Logistics Technical document associated with this study..

Estey was appointed by the Minister of Transport to undertake a review of the grain handling and transportation system. His report, issued a year later, made a number of recommendations that ultimately laid the foundation for the reforms brought forward as amendments to the CTA in 2000, including a recommendation that the maximum rate scale be replaced with an annual ceiling on the revenues that CN and CP could earn from the movement of regulated grain – the revenue cap or maximum grain revenue entitlement (MRE).

The MRE is better characterized as an inflationary control mechanism. In effect, it contains any increase in railway freight rates to reflect the rise in underlying costs. In short, it attempts to ensure that any escalation in the freight rates associated with moving grain is consistent with the underlying rate of inflation and capital costs. The MRE does not, in and of itself, limit the amount of grain that a railway may handle. Further, it does not preclude a railway from pricing differentially – be it in terms of commodity type, equipment, corridor, season or volume – and which the railways employ regularly in the rates applied to the movement of Western Canadian grain. All things being equal, if a railway were to see a doubling or even tripling of its grain volumes, its revenues would rise correspondingly.

The MRE is calculated annually by the Canadian Transportation Agency by adjusting the revenue per tonne value from the base year (2000-01) to account for changes in total tonnage, average length of haul and prices of railway inputs, as outlined in the Volume Related Composite Price Index (VRCPI). [18] The VRCPI is, by regulation, calculated and published by the Agency prior to the coming crop year. Calculation of the MRE is done after the completion of the crop year, and is further adjusted by other cost related adjustments such as the annual amortization on specific grain industry related capital investments that have been made as well as specific grain industry related operating costs incurred by the railways. If the railways exceed the allowable MRE in a given crop year any excess revenue plus a penalty is to be repaid.[19]

The structure of the MRE gives the railways the commercial freedom to establish market based freight rates as long as total freight revenues do not exceed the cap. Under the MRE, the railways can set rates to reflect differences in commodity type, geographic location at both origin and destination and to adjust these rates seasonally. They are also able to price blocks of cars differently, for example multi-car block rates are set for 25, 50, or 100 car blocks. Both railways use all of these rate mechanisms to influence the timing of movement and to incent shippers towards specific routes, origins and destinations. Unlike prior rail rate regulation the MRE structure permits the railways to retain the benefits of any productivity improvements going forward, including those gained through the adaptation of technology and improved processes.

In 2008, the federal government initiated the Rail Freight Service Review to address rail shippers ongoing concerns about the state of railway service in Canada. The purpose of the review was to examine the performance of the rail based freight logistics system in Canada and identify issues impacting railway service stemming from all stakeholders operations and activities, including railways, shippers, receivers and other logistics partners.

In its December 2010 report to the federal government the Rail Freight Service Review Panel concluded that a commercial rather than a regulatory approach provided the best means of addressing existing system problems. The report made four recommendations that were subsequently accepted by the federal government. They included:

[18] The VRCPI is a composite index of the forecasted prices for railway labour, fuel, material and capital purchases. It is designed to adjust the MRE to reflect changes in railway variable costs based on a weighted "basket" of input prices using 1992 based price indices for each input component. As originally constructed the VRCPI consisted of six input components weighted to reflect the ratio of the individual component cost to the total "basket of costs". Input components included labour, fuel, material, leased cars, depreciation, and cost of capital.

[19] Railway re-payments including penalties are made to the Western Grains Research Foundation

- The establishment of a facilitated process to develop a template service agreement and a commercial dispute resolution mechanism in consultation with system stakeholders (otherwise known as the 'Dinning process', after Mr. Jim Dinning, the independent facilitator appointed to lead the process which concluded in June 2012).

- The introduction of a Bill in Parliament to give shippers the right to a service agreement with the railways and a process to establish an agreement should commercial negotiations fails (a commitment fulfilled through the passage of Bill C-52 *The Fair Rail Freight Service Act*, which received Royal Assent in June 2013).

- The establishment of a Commodity Supply Chain Table to provide a forum for addressing logistics issues and to develop performance metrics that would be made public.

- Completion of a detailed analysis of the grain supply chain (the focus of this report).

Grain Quality and Safety

Grain quality and safety are regulated through several different pieces of federal legislation: the *Canada Grain Act* (CGA) (which is administered by the Canadian Grain Commission); and the *Canada Agricultural Products Act*, the *Plant Breeders' Rights Act*, the *Plant Protection Act*, and the *Seeds Act*, which are all administered by the Canadian Food Inspection Agency (CFIA).

The CGA is the Act that establishes the Canadian Grain Commission (CGC) which in turn serves as regulator for the Canadian grain industry. The CGC certifies the quality, safety and weight of Canadian grain as well as conducting research on grain quality and protecting producers' rights to deliver grain into the licensed elevator system and to load and ship producer cars.

Grain quality covers end-use processing attributes, safety, cleanliness and sometimes variety composition in shipments of grain. Grain grades are a measure of grain quality. The CGC sets the standards and specifications for grades of grain on the basis of recommendations from the Eastern and Western Standards Committees.[20] The complete reference on grading of grains, oilseeds and pulses used by grain inspectors is the Official Grain Grading Guide. All grain delivered into the licensed elevator system in Canada is subject to official grading.

The CGC is also responsible for outward weighing and inspection of export grain loaded to ocean vessels to ensure that export standards for weight, grade and other specified attributes are met.

The CFIA's principal role within Canada's grain export supply chain system is to inspect ocean going vessels to certify phytosanitary compliance in accordance with Canadian regulations and to ensure that all grains for human consumption comply with Health Canada regulations. The agency provides inspection services in three areas: empty vessels arriving to load export grain, loaded vessels importing goods to Canada and agricultural exports departing Canada.

Changes in the Market Environment

In the mid-twentieth century, countries around the world, in the interest of establishing a national food strategy, established State Trading Enterprises (STE) for the purchase and sale of certain commodities strategic to their economic interests. In Canada, the *Canadian Wheat Board Act* of 1935 initially established the Canadian Wheat Board as a voluntary marketing agency with the federal government responsible for

[20] Standards Committees, including grain producers, processors, exporters and government representatives, meet twice a year to ensure that the grading system reflects the interests of all sectors of the Canadian industry and remains relevant to these sectors and to buyers of Canada's grain (including making recommendations on specifications and grades found in the Official Grain Grading Guide).

covering any marketing losses while profits flowed to participating farmers. Through the years of WWII the role of the CWB gradually increased as it took control of the allocation of rail cars. In 1943, it was confirmed as the sole marketer of many grains grown in Western Canada. In subsequent years, various changes were made to the jurisdiction of the Board including the removal of oilseeds, domestic feed grains and oats from the Board's control.

The *Canadian Wheat Board Act* empowered the Board with the mandate to: contract and source grain from producers, direct that grain to specific elevators, direct the grain company to load and forward grain to terminal elevators designated by them; direct the railway to supply cars to specific country elevators; and direct the terminal elevator to load specific ocean vessels with the delivered grain. They also had the choice as to contracting the ocean vessel (dependent on the terms of the sales contract).

In the early years when the preponderance of Western Canadian grain exports were marketed by the CWB, the relationship between the grain company and the Board was like a dealer/warehouse agent, with the grain company providing a service. As producers began to diversify their cropping patterns and other grains began to move into the global markets, the system became more complex. While over 80% of western grain production was marketed by the Board 30 years ago, by 2011 that proportion had fallen to less than 58%. Grain companies still acted as agents and warehousers of CWB grains, but assumed much larger roles as buyers and marketers of all other grains.

In December 2011*, The Marketing Freedom for Grain Farmers Act*, received Royal Assent removing the CWB's 70 year monopoly over the sale of western Canadian wheat and barley giving farmers the right to sell their grain on the open market. The Act also provided for the transformation of the CWB into a voluntary marketing entity, with interim support from the federal government while the organization transitioned to full private ownership. In addition, the CWB would itself be able to engage in the sale of any grain, not just wheat and barley.[21] The legislation also enabled producers and grain companies to forward contract for the delivery of wheat and barley on or after August 1, 2012.

With the introduction of *The Marketing Freedom for Grain Farmers Act,* the federal government also acknowledged that the Port of Churchill might face a greater challenge in adapting to the realities of an open market than other ports in Western Canada. This was due in large measure to the significant role historically played by the CWB in directing grain to the port for export. Building on what it considered to be the importance of maintaining the Port of Churchill as a viable shipping option, the government announced that it would provide an economic incentive of up to $5.0 million per year for five years to support shipments of grain, including oilseeds, pulses and special crops, through this gateway. This was subsequently formalized as the Churchill Port Utilization Program with an allocation of $9.00 per tonne available to exporters on a priority application basis. In addition, the government also indicated that it would be providing up to $4.1 million over three years to maintain the Port. [22]

In conclusion, the Canadian grain industry has undergone significant evolution throughout its history, with many changes occurring as a result of an evolving regulatory environment. The recent enactment of the *Marketing Freedom for Grain Farmers Act* and the removal of the Canadian Wheat Board's monopoly over

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[21] The extension of the new CWB's right to engage in the sale of additional grains would be limited only by *The Canada Grain Act*.

[22] OmniTRAX, the operator of the Hudson Bay port, has had to assume the coordination and management of the rail shipping program into Churchill and vessel program out of the port. Previously this function was largely handled by the CWB. The larger number of shippers involved adds complexity and cost, leading to an increase in terminal handling rates at the port. Recognizing the need to be more self-sufficient, OmniTRAX has obtained a grain dealer's license from the CGC in order to be able to take advantage of market opportunities that may present themselves.

wheat and barley sales have introduced a structural change to historical marketing strategies. It has also resulted in the removal of an established participant in the logistics system that previously exercised direct control over the movement of two-thirds of western Canadian grain.

Supply Chain Concepts

The basic tenets of any supply chain can be brought down to three fundamental parts: Produce a product, sell it, and then deliver it. In this section of the report we discuss the basics of supply chain concepts and how they apply to Canada's grain supply chain.

It is appropriate to begin the discussion of Canada's grain supply chain with a discussion of the basic principles of supply chains in general as it sets the stage for the discussion throughout this report.

A supply chain is best described as an interconnected network of businesses involved in the production, planning and delivery of goods or services to end customers. This fundamental understanding is both very simple and profound at the same time.

A critical and fundamental principle in understanding the workings of any supply chain is the interconnected nature of the different businesses' processes and how their actions often have significant impact on others in the supply chain. Therefore, as businesses operate with their own best interests in mind, there is a potential for conflict when the business interests of the supply chain partners do not properly align. As most supply chains (particularly the Canadian grain supply chains) operate as networks with many participants jointly using common infrastructure (like railways and ports), the potential for misaligned priorities is multiplied even further.

All supply chains are dependent on the communication of information between the supply chain partners. Information on supply and demand signals are the most important parts of this communication and it flows in many different ways. It has a significant impact on many aspects of the supply chain including price, the management of logistics capacity and the management of capital and resources for all participants. The reader can find a table matrix detailing supply chain relationships in Appendix 4.

Finally, supply chain management involves extensive planning of operations. Planning involves looking to the future – predicting the future and assigning and acquiring resources to meet current and future needs. Therefore planning requires that information be available and reliable about the future capacity of suppliers of services and future demand of those using those services.

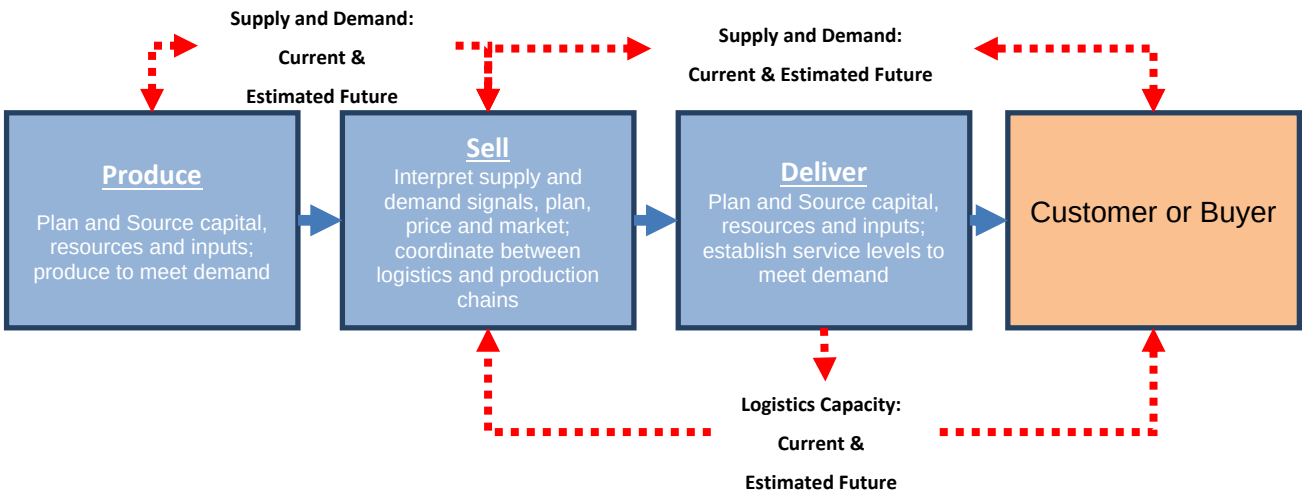
The normal model of a supply chain is a group of businesses that jointly:

- **Produce the product** - manufacture the product, goods, grow crops, starting with sourcing the capital, material and labour resources required to deliver the product/services
- **Sell** – the process of selling or marketing the products made
- **Deliver** - coordinate logistics to get products to end use customers

This requires planning for each member of the chain, and interaction between the members to ensure coordination. However, for each member of a supply chain, all activities must be done. No partner is involved in only one step. A better way to think about a supply chain might be as shown in Figure 6 where each participant in the supply chain is seen to be active in all of the customary supply chain activities. Furthermore, as emphasized in the diagram, the sharing of information about supply and demand is always uncertain. Signals about future demand are always about "estimated" demand. Signals about future capacity are always about "estimated" capacity. In any given supply chain, the underlying conditions that contribute to this uncertainty will be different. In the Canadian grain supply chain context, as will be seen later on in this report, the sources of uncertainty are numerous. They include; rainfall, snowfall, producer

planting decisions, railway investment decisions, grain company marketing decisions and world commodity market competitive conditions.

Figure 6: Supply Chain Fundamentals



As noted above, supply chain management involves organizing logistics activities across the boundaries of organizations. In the case of the grain supply chain – like many other bulk products supply chains – this is made more complex because some of the assets used in the supply chain, such as railways and ports, are shared by many users both within and beyond the grain industry. As these other industries do not directly coordinate their demands with each other, it is left to the asset owners and in some cases to regulatory authorities to perform this coordinating role where conflicts occur in the logistics system.

Canadian Grain Supply Chain Context

The general foundation of supply chain principles is easily applied to Canada's grain supply chain. While supply and logistics chains are commonly viewed in a linear manner it is important to recognize that any supply chain is necessarily dynamic with supply and demand signals constantly flowing back and forth throughout the network of supply chain participants. Accompanying these are the signals related to the supply chain's capacity, commodity prices and operational challenges impacting the smooth delivery of grain products. In the following sections of this report we discuss the many processes and challenges faced by the stakeholders in Canada's grain supply chain.

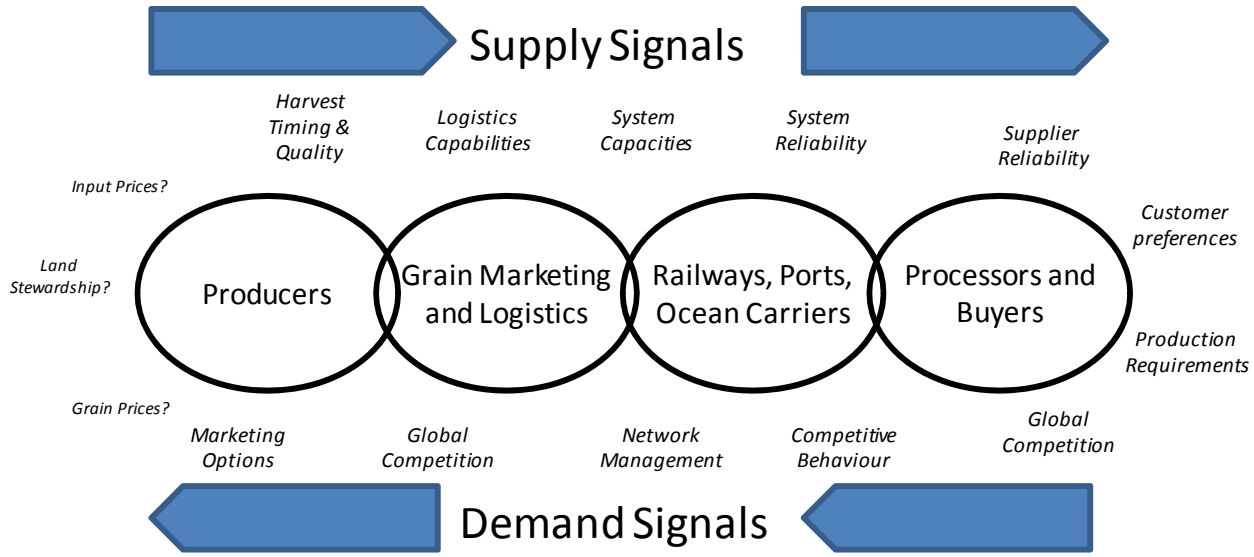
From Producer to Processor

The processes and activities that facilitate the movement of grain from producers to consumers require a high degree of integrated planning and operations across all stakeholder groups. One way of thinking about the grain supply chain is starting from the producers' point of view and moving through to the final consumer.

At each stage of the supply chain, the participants face uncertainty. A critical role of all participants in the supply chain is to estimate the potential for variability in their own and their partners' performance, and to take steps to mitigate the impact of such variability. The chart in Figure 7 shows only some of the various factors that each participant in the supply chain must consider when making planning, marketing and production decisions. From the producer's point of view, a factor affecting production decisions is the long lead time between when inputs must be purchased and the crop is harvested and made available for sale to

buyers. For most agricultural products in Canada, there is only one harvest each year and the decisions on what will be seeded can begin a year before the crop is harvested. In addition, prudent agronomic practices require good land stewardship through strategically managed actions such as crop rotation and planned application of crop inputs. Different crops require different types of expertise with varying degrees of risk and cost of production. In addition, not all land and climate conditions are suitable for all types of crops. These factors mean that market signals are only one of the factors that affect producer decisions.

Figure 7: From producer to processor



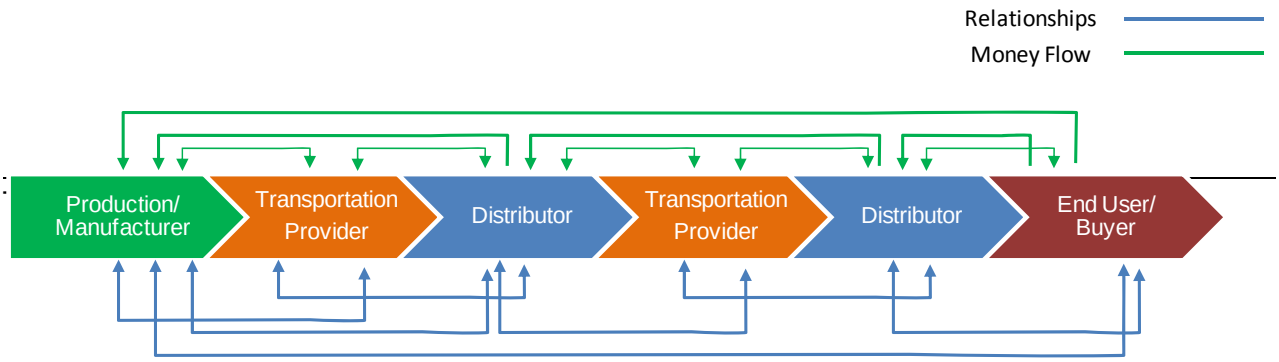
This complexity of production is matched by the complexity of the market place. Grain marketing and logistics companies must consider the expected conditions in world markets and the capacity of their logistics providers – such as railways – before they make sales decisions. In turn, railways must estimate their capacity to handle business based upon the needs of their many customers – all of whom face market uncertainty. Railway crews, locomotives and cars cannot be added to or removed from their system on short notice and the price of overinvestment is poor financial performance. The price of underinvestment is borne by both the railway and its customers in lost business.

In general, as emphasized above, demand and capacity information must be exchanged between supply chain partners for all key activities. This has both long term planning and short term operational aspects. Thus while longer term, annual or monthly demand and capacity planning information must be exchanged between supply chain partners they must also have access to accurate day to day performance and status information to allow them to optimally manage their processes. For example, grain companies will not want to ship a specific type and grade of grain to a port elevator unless they have confidence that the elevator has the capacity to; unload the grain, process it as necessary (cleaning and blending), and load it to a scheduled vessel to avoid conflicts with other sales that are scheduled to use the same port terminal.

Unique Attributes of the Canadian Grain Supply Chain

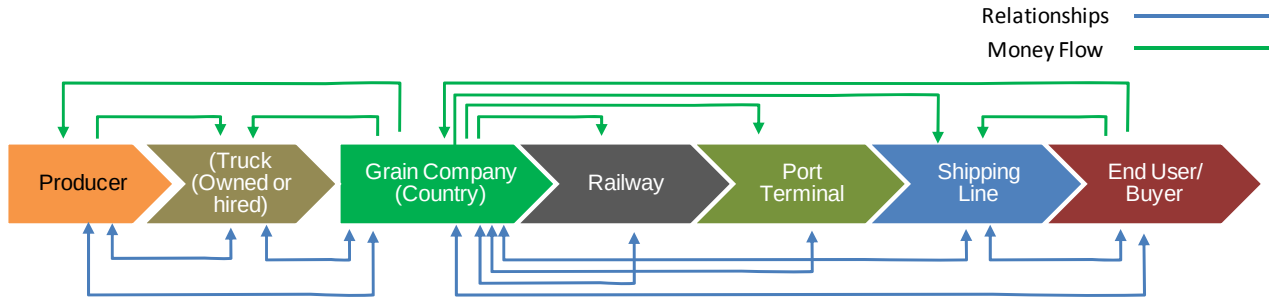
A typical supply chain, as portrayed in Figure 8, will posses relationship attributes that run up and down the supply chain, typically seeing links between the end user or buyer and the producer of the product either directly or through a distributor. The fundamental characteristic that is common through a generic supply chain is the stakeholder who is in control of the production of the product has a direct involvement in the whole of the supply chain and as such exercises control of the supply chain activities. The flow of money will typically move from the buyer to the seller and supply chain costs will be passed through the supply chain.

Figure 8 - A generic supply chain relationship and cash flow model



The Canadian grain supply chain has one fundamentally unique attribute in that the production of the product is one step removed from the rest of the supply chain, as portrayed in Figure 9 below. Producers' (farmers) relationship with the supply chain will generally be at a single point– through the grain company - who buys their grain and then market and manage all subsequent logistics for the movement to the end buyer. The relationships and attendant supply chain costs associated with all aspects of the sale and movement are factored into the price obtained by the farmer at the country elevator when grain is delivered.

Figure 9 - The Canadian Grain Supply Chain Model (Bulk product through the country elevation system)



Consequently the producers of Canadian grain do not have direct participation or formal commercial relationships with the other participants in the supply chain except for the grain company they are selling to, however, they must accepts the costs that flow back through the supply chain and are reflected in the price paid for their grain.

Supply Chain Constraints and Dependencies

Supply chain failure can occur when participants fail to plan for the movement of the right products, at the right time through the logistics system from producer to processor. As noted above, all logistics planning takes place in an atmosphere of uncertainty about future demand and capacity. The following is a high level summary of the major sources of uncertainty in each of the primary grain supply chain systems and the types of constraints and common problems that arise. The reader will find more detailed discussion of supply chain challenges and performance issues are dealt with in the balance of the report.

Bulk Grain Exports

The flow of grain that moves via Canada's west coast ports to global markets is the one that is most challenging for stakeholders as it must move through a few highly utilized port terminal elevators, particularly at Vancouver, which handles the great majority of this volume.

Sources of Uncertainty	Important System Constraints	Impacts / Problems
Timing of harvest • Harvest may occur between late August and October depending on the crop, location and weather factors **Quality and quantity of grain** • The volume of various grades and qualities of grain cannot be completely understood until harvest is completed **Railway capacity** • Available capacity can be affected by weather, and the demands of other system users • Over the longer term, the railway system has generally been able to accommodate total volumes offered for carriage; however it is characterized as a source of uncertainty rather than constraint as it is sometimes hard to predict the ability of the rail system to respond to demand changes over seasonal planning periods.	**Port terminal capacity** • The ratio of storage to throughput at West Coast terminal elevators is very low, requiring elevator users to match inbound rail volumes and grades to planned vessel arrivals. • Port terminal throughput can be affected by weather events and by the match between the grains held in store and the grains required for loading. **Terms of sale in international markets** • Grain price premiums are often the highest in the immediate post harvest months due to international cycles of production of grain. This creates high demand for transportation in the Oct – Dec period. • Terms of sale dictate that much of the crop may be sold up to 90 days in advance, or more.	If future sales programs do not match either future capacity or the grain that is actually moved to and held in storage at port terminals – vessels scheduled for loading at port may be delayed – resulting in high costs for vessel demurrage, sales cancellation costs, lost business and damage to Canada's reputation as a reliable supplier. If forecasts of future export shipping demand are not accurate, railways may over or under invest in rail capacity resulting in financial consequences for all supply chain stakeholders.

Containerized Grain Exports

Containerized, as opposed to bulk shipments of grain are used for products for which receivers do not have the capability of handling bulk shipments and for shipments of products that are sensitive to bulk handling or are bagged and shipped in small volumes. The volume of grain moving in containers has grown from less than 3% in the 2000-01 crop years to almost 13% of total grain exports in the 2010 -11 crop year.

Pulse and special crops make up the majority of containerized exports. The great majority of containerized grain exports move through the ports of Vancouver and Montreal with a much smaller volume handled through the port of Halifax. Containerized grain may be loaded to ocean containers directly at processors at inland locations or it may be shipped via rail for transloading to ocean containers at the ports.

Table 4: Uncertainty and constraints in containerized grain exports

Sources of Uncertainty	Important System Constraints	Impacts / Problems
Availability of inland transportation capacity • For inland container movements, shippers rely on backhaul movements of ocean containers and domestic containers. The availability of this capacity is dependent on demand for the higher revenue earning head haul traffic. • For rail car movements to port, shippers rely on the supply of box cars and hopper cars. • The availability of both forms of inland transportation is subject to conditions of transportation markets and weather conditions. **Lack of accountability in the ocean container booking processes** • Generally, there are no direct financial consequences to shippers or shipping lines for failing to honour the terms of a container booking.	**Port transloader storage and throughput capacity** • Very limited storage capacity of containerized grain products is available at port transload locations and many products are sensitive to the rough handling of most bulk storage systems. **Containerized ocean vessel scheduling** • Containerized ocean vessels move on fixed schedules with very limited time spent in port for loading and unloading of containers. Shipping lines provide container "bookings" specific to vessel schedules with very narrow windows for shippers to deliver containers to port to meet individual vessel schedules.	Shippers and their logistics providers must schedule inland shipments to match available container capacity and shipping schedules at ports. If inland shipments arrive too late to be loaded to containers for their scheduled departure, ocean shipping lines will have unused vessel space decreasing their utilization and increasing costs for all system users. Shippers who miss port shipping windows or whose containers do not move on the booked vessel, may lose contracts, suffer damage to their reputation or incur contract default costs.

Processed grain product shipments

Grain products moving through processing facilities require careful coordination of logistics for both the inbound (unprocessed grain) and outbound (processed products) movements. These processors include both flour mills using inbound wheat and oilseed crushing facilities using primarily canola seed and shipping out oil and canola meal. Shipments through these facilities are less likely to be as highly seasonal as export movements of unprocessed grains. However, some of these facilities, particularly canola crushing plants located in Western Canada, can be highly dependent on railway transportation for the outbound movement of their products. When rail service is uncertain or subject to unplanned variation, it can affect the scheduling of processing activities within the plant and the efficiency of operations.

Summary

All supply chains are comprised of several activities and sub chains with multiple participants managing the processes within the confines of their own direct control while coordinating with their partners. The supply chain relies heavily on communication and the exchange of information ranging from levels of supply and demand to how well certain parts of the system are working at any given point in time. All participants in the chain look for both supply and demand signals from the market – to plan for capacity and to coordinate the resources required to deliver on prospective sales being negotiated.

No supply chain is without its challenges and flaws. The major challenges to the Canadian grain supply chain stem from the supply chain heavy reliance on rail as its primary mode of movement to export position and the underlying challenges of Canada's extraordinarily unique geography and climate. Much of the challenge faced by policy makers stems from the separation of the grain producer's commercial relationship from the remainder of the supply chains stakeholders which constrains the producer's ability to influence decisions and drivers to the systems cost base that has so much impact on their own profitability.

The Canadian Grain Marketing System

The following section describes the critical structural elements and processes involved in the marketing and sale of Canadian grains and grain products in domestic and international markets. Principal areas of discussion include:

- How Canada competes: the role of price, quality and product specific attributes in international markets
- Market structure: a description of buyers and sellers
- Market and product development: the role of government, industry associations and private industry in these areas, Market channel selection, how market participants select and the implications on supply chain logistics that result from the selection of such channels
- Sales and contract negotiation: the processes involved in the execution of sales contracts; and
- Sustaining markets: the importance of the customer and the mechanisms used to maintain and grow Canada's market share

How Canada Competes

Price vs. Quality

Canadian grains and grain products whether wheat, barley, oilseed and oilseed products or pulse crops compete in domestic and international markets on the basis of numerous factors including price, product quality, product specific characteristics or attributes, security of supply and increasingly on the basis of supply chain efficiency.

There is a consensus among grain industry participants interviewed that with few exceptions, Canada is a price taker in most commodities traded globally.

During bilateral consultations grain company marketing representatives and representatives of the CWB were asked to provide their views on the ability of Canadian grain marketers to influence demand and timing of sales for Canadian grain. More specifically they were asked to comment on the extent to which Canada is a "price taker" in global markets and the impact of grain quality issues on demand and pricing.

There is consensus among stakeholders that with few exceptions Canada is a price taker in most agricultural commodities traded globally. Generally speaking these stakeholders argue that the size and transparency of global markets do not allow Canada – as a relatively small player – to influence price. This being said it is recognized that pricing is ultimately influenced by product quality, supply reliability, port accessibility and security issues. All of these factors, in addition to the broader market supply/demand issues, are considered by buyers in determining what they are prepared to pay for Canadian grains. The CWB suggested that in its prior role as sole marketer of wheat and barley and through the use of single desk selling, it had the ability to offer buyers added value by managing supply availability on a year round basis.

Stakeholders acknowledge that while some customers do buy Canadian grain based solely on price there are specific markets – in wheat for instance – where consistent and superior product quality is a differentiating factor and an important driver of demand thereby yielding some measure of premium pricing. Noteworthy examples include the British bakery Warburton's that pays a premium for Canadian AC Barrie wheat because they believe it to be of a higher quality than similar wheat grown in the United Kingdom. Similarly Japanese

buyers, including the Japanese Food Agency, are willing to pay a premium for the quality and consistency of Canadian hard red spring wheat and buyers in the Philippines ascribe value to Canada's high phytosanitary standards.

A number of stakeholders however question whether premium pricing results in higher margins. While acknowledging that Canada is successful in extracting a price premium for some grains in some markets they are not convinced that this translates into improved margins due to the additional costs associated with achieving these quality standards. The premium gained in price is thought to be offset by the incremental handling costs.

Beyond price and quality considerations Canadian grains and grain products do compete globally on the basis of specific product attributes including health and nutritional value and suitability for downstream manufacturing and processing activities.

> **Substitutability** – Some agri-food products are unique while others are highly substitutable within individual production processes. To the extent that a product can maintain its unique properties for an extended period, within the context of overall supply and demand, this characteristic can be positive for enduring market value. Canadian mustard is an example of such a product that has no immediate competing substitute of reasonable quality. [23]
>
> **Health & nutritional benefits** – Some grains and grain products are valued for and compete on the basis of perceived health and nutritional benefits. For example, the fatty acid profile of canola oil has been the driving force behind its growth as a major food ingredient. Its attributes are such that in 2006 the U.S. Food and Drug Administration authorized a qualified health claim for canola oil based on its high percentage of unsaturated fats. High oleic canola has continued to make further inroads with processors and consumers because of its presumed health advantages.
>
> **Cleanliness** – Relative to other origins, Canada may provide supplies that are perceived as being cleaner (more consistently). This can be - in the case of companies that adopt ISO9000 quality standards - because of individual initiative. It may also be due to how certain buyers perceive the overall integrity of the Canada's quality control system.

Table 5 provides a summary of some of the specific product attributes (e.g. hardness, gluten and protein) that are important to buyers of Canadian grain and grain products.

The relative importance of such factors to buyers, whether real or perceived, will differ across buyers, markets and time and will be influenced by technological developments in processing and manufacturing operations. These factors have in the past and will continue to drive shifts in production patterns and origin-destination patterns, which in turn have supply chain implications. Canadian field crop production must ultimately create simultaneous value for both producers and consumers. If consumers fail to place value on a particular crop—or choose to buy from another origin—then farmers will shift acreage to another product that is suitable for production in their area for which they can earn an acceptable return.

[23] For some other grains technological developments resulting from research and development activities can overcome unique product attributes. For instance developments in processing technology have allowed processors to extract gluten from lower protein wheat creating the ability to "extend" the functionality of lower protein wheat and reducing the value of and demand for high protein red wheat in some markets.

Table 5: Wheat Classes, attributes and end uses

Type of Wheat	Hardness	Gluten		Protein	Uses of Wheat
	PSI	*FS*	*MTI*	*%*	
Durum	35-42	1	160 +	16	Pasta (Semolina) Burghui, Couscous, Frekah
Some HWS	42-46	3	140	15	
HRS, HWS	46-55	5	120	14	Burghui, Couscous
HRW, HWW, CPS (red)	55-60	7	100	13	
CPS	60-65	9	80	12	Raised Breads, Pan breads, Hearth Breads
SWS, SRS	65-68	11	60	11	Blending with local softer wheats for bread and noodles
SWW, SRW	68-72	13	40	10	Flat breads French baguettes, some noodles/ crackers
SRW, White Club	72-76	15	20	9	Blending with harder wheats for noodles and crackers
		17+	0 -	8	
				7	Cakes, pastries, biscuits (cookies) some noodles)
				6	

Hardness – Kernel hardness is measured using a Particle Size Index (PSI), the lower the PSI, the harder the kernel
Gluten – The gluten and dough strength of the grain is measured by farinograph stability (FS) and the mixing tolerance index (MTI)
Protein - Protein is measured based on the percentage of protein in the grain

Market Structure

Grain markets, much like most other markets, are made up of buyers and sellers that seek to match supply with demand at a price acceptable to both parties. In the case of grain the market participants can be very different depending on the specific grains and grain products being sold, whether in domestic or international markets and depending on lot sizes transacted. (See Figure 10)

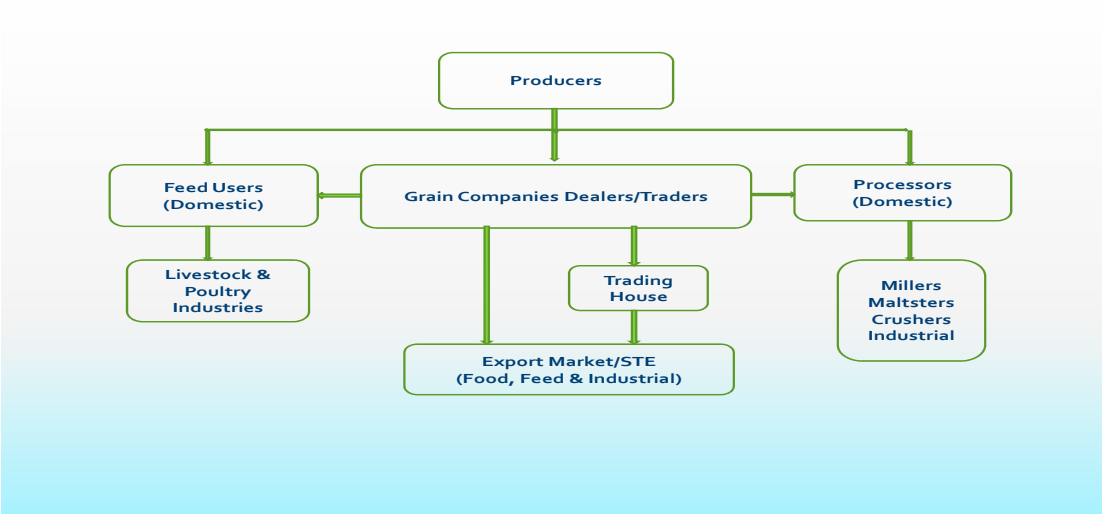


Figure 10: Market Structure

The buyers and sellers of Canadian grains and grain products can vary from multi-national merchants or national government state trading enterprises (STE) to small private sector processors operating in niche commodity

markets. The purchasing and sales strategies of stakeholders, the nature and structure of commercial transactions and the logistics systems that support the movement of commodities from producing to consuming markets will vary based on the location and capabilities of both buyers and sellers.

Producers

Producers' principal supply chain relationships are with the grain companies, marketers and processors who contract with them for the supply of grain from processing and subsequent sale in domestic and export markets. Arrays of contracting options as well as cash sales are available to producers. Contracting options include: production contracts, deferred delivery contracts, basis contracts, deferred pricing contracts and target price contracts. Terms of contracts vary across companies, necessitating scrutiny by producers prior to signing. Greater detail on marketing options is provided in the Marketing and Logistics Technical document associated with this report.

Pulse and special crops producers typically have access to a smaller set of contracting options. In addition to cash delivery many buyers will offer production contracts and deferred Delivery Contracts (locking in price only). Much like producers of other grains scrutiny of contract details is important as they vary from company to company. With no futures markets providing price discovery for pulses and special crops, there are no basis-related contracting options.

Grain Companies, Dealers and Traders

The producer's first point of contact is usually with a grain company that has a primary elevator or network of primary elevators ready to receive delivery of his/her product. The grain company may transform the product through cleaning or drying, etc., in preparation for further marketing or processing. Many grain companies are fully integrated entities with processing divisions as well as export terminals and export marketing services. A description of the Canadian Grain Companies can be found in Appendix 5.

Although some dealers transact directly with producers, grain dealers or traders most often play the role of facilitator or "middleman" in large volume grain sales, where the receivable is "laid off" to another party (buyer or seller) and the trader works for a commission. In some transactions, typically involving smaller volumes, the trader may act as both buyer and seller (as a trading house would). They are active participants in specialty grain markets that sell in smaller lot sizes and as such Canadian grain dealers and traders are large users of international containers. A map of the Western Canadian country elevator network can be seen in Appendix 6.

Trading Houses

Trading houses are commodity brokers that buy and sell grain in large volumes, often using price-hedging facilities to optimize the profitability of a trade. These organizations will often assume the majority of the trade's risk in exchange for greater margin share based on their ability to deal in large volumes and their financial strength.

In Japan for example, many corporate name brands known for production of manufactured products began as commodity traders. International giants Mitsubishi, Mitsui & Co, Sumitomo Corp, Itochu and Marubeni are the five largest Japanese trading houses and all actively buy and sell Canadian grains. In China, Jardine Matheson (Jardine's) of Hong Kong and MMTC of India are other major global trading houses that trade Canadian grains.

State Trading Enterprises

The World Trade Organization (WTO) defines state trading enterprises as "governmental and non-governmental enterprises, including marketing boards, which deal with goods for export and/or import". While no statistics are available with respect to the proportion of Canada's grain that is sold to or through these organizations they are recognized as important buyers of Canadian wheat and other grains.

As a buyer in global markets a state trading enterprise's relationship with a seller such as Canada would normally be with its counterpart in that country if such an agency existed. For Canadian wheat and barley this previously would have been the CWB or an accredited exporter operating on the CWB's behalf. With the removal of the single desk, foreign STEs now have the ability to transact grain purchases with an individual grain company or grain dealer as well as the CWB. State trading enterprises often fulfill the role of commodity purchaser and supplier to smaller national entities that are responsible for selling and distributing products to domestic end users. An STE will use its volume buying power to obtain favorable pricing and take advantage of bulk movement logistics in order to optimize both price and operational efficiencies. The use of strategic assets such as large scale storage terminals is also typical of countries that trade through STEs. The grain terminal at Dalian, China for instance has a storage capacity of more than one million tonnes and is one of the most modern in the world.

Processors and Manufacturers

Many off shore processors and food manufacturers look to buy raw grain products from Canada as feedstock for their own processing operations. Grains such as canola, mustard and feed peas are shipped in bulk lots to crushing or food manufacturing plants. Smaller manufacturing plants often look to containers as a logistical alternative as they can use the container as a form of onsite storage when it arrives.

Domestic Buyers

The main domestic purchasers and users of Canadian grains are the processing and feed industries. The processing industry primarily consists of maltsters, millers, oilseed crushers and ethanol plants.

Malting is the process of germinating cereal grains (usually barley) to allow starch to convert to sugar and enzymes to develop. The process is terminated by kiln drying prior to the malt being used in the brewing (primary) and confection food (secondary) industries. Over one million tonnes of Canadian malting barley are processed annually. Over 65% of this production is exported – approximately 500,000 tonnes valued at over $200 million.[24] There are four major malting companies located in Canada operating a total of six plants.

Milling in a general sense is the process of grinding grains to make smaller particles (flour) which can be used for further processing or baking. The Canadian Milling industry consists of nearly one hundred establishments, which are located in eight provinces. Forty-eight of these are wheat milling establishments and seven are oat milling.[25] Canadian mills grind over 3.5 million tonnes of wheat, oats and barley annually with a shipment value estimated at $1.2 billion.[26] The thirteen members of the Canadian National Millers Association who collectively operate 29 plants constitute the bulk of production. Although overall milling capacity is shared about equally between Eastern and Western Canada, the majority of the wheat milling is located in the east near major population centres and the majority of the oat milling is located in the Prairie Provinces.

[24] Source: Malting Industry Association of Canada.
[25] The remainder is primarily specialized (non-major grains) and further processing establishments.
[26] Source: Canadian National Millers Association.

Crushing oilseeds (canola and soybean) produces oil and protein meal. The oil, approximately 45% of the volume for canola (20% for soybean), is used for edible foods and for biodiesel production. The meal, approximately 55% of the volume for canola (80% for soybean), is used for livestock feed. In 2010, 7.1 million tonnes of oilseeds were crushed in Canada with a combined export and domestic sales value for the oil and meal of $4.4 billion.[27] There are six oilseed processing companies operating in Canada operating a total of 13 crushing plants of which all but three are located in Western Canada. On October 10, 2012 Cargill Ltd. announced plans to build a new canola crushing facility near Camrose, AB. When complete in time for the 2014-15 canola harvest this plant will add 850,000 tonnes or approximately 10% of annual crushing capacity to the Canadian system.

Ethanol, a renewable fuel, can be made from any feedstock containing starch and/or sugar. In Canada, ethanol is produced primarily using corn and cereal grains – corn in Eastern Canada and usually wheat in Western Canada. A by-product of the fuel production, accounting for about 30% of the volume, is distillers' grains. Containing protein, fat, fiber, minerals and vitamins, distillers' grains are a valuable feed ingredient for the livestock industry. There are currently 12 ethanol producers in Canada operating 15 plants with total production capacity of more than 1.7 billion litres of ethanol.[28]

Feed Market

Livestock production accounts for between 40 and 50% of Canadian farm cash receipts and is supported by a diverse domestic feed industry. Although wheat, barley and corn constitute a substantial amount of the feedstock, the by-products of industrial processing such as canola crushing and ethanol production (canola meal and distillers' grains) supplement this supply.

Industry Canada lists 82 animal feed manufacturers on its website. These companies, located all across Canada, range in size from small specialty producers to large multi-facility full service feed manufacturers and distributors.

There are both domestic and export components to the market for feed grains. The export market for Canadian feed grains is highly elastic and can fluctuate widely from year-to-year depending on relative prices. Large consumers such as South Korea purchase significant quantities of Canadian feed barley some years into the future.

Essentially, their livestock and poultry production (beef, dairy, pork, chicken, turkey, etc.) is dependent on reasonably priced sources of protein. Feed wheat and barley, corn, soybean and canola meal, distillers' grains and forage (hay or silage) may all be used. In many instances these protein sources are highly substitutable depending on price.

In other markets specific attributes may be sought as is the case with the growing desire to incorporate canola meal into the diet of dairy cattle. Canada has been able to secure a reliable market in the U.S. for a large part of the meal by-product of our canola crushing industry.

Depending on the price relationships, imports of American corn or distillers' grains may find their way into the Canadian feed market. Western Canadian feed barley will find its way into the export market when that price is high enough to cover the added logistics costs and attract it away from the domestic market. And at other times, the ability of the feed market to absorb product not in demand may provide support for quality premiums in the balance of the crop.

[27] Source: Canadian Oilseed Processors Association.
[28] Canadian Renewable Fuels Association, November 2010

An Evolving Industry

At one time the sellers of Canadian grains and grain products could be segregated based on the commodities they sold – wheat and barley versus all other grains and grain products – however this is no longer the case. Prior to August 1, 2012 the CWB was the sole marketing agent for western Canadian wheat and barley sold in export markets and for domestic sales for human consumption. In this capacity the CWB directly marketed the majority of Canadian wheat, durum and barley using its own marketing staff located in sales offices at home and abroad.

The dynamics of grain markets and grain marketing activities have changed since August 1, 2012 with the removal of the CWB's monopoly on the sale of wheat and barley. This has altered the way in which these grains are marketed and sold, who can sell them and likely will change the nature of market development efforts in the future.

In international markets the CWB sometimes used agents to market and transact sales for wheat and barley on its behalf. Accredited Exporters (AE), of which there were fifteen companies, were authorized to purchase grain from the CWB for resale to customers and other exporters. Estimates within the industry vary; however, the consensus is that as much as 40% of wheat, durum and barley export sales involved an AE. These companies delivered value to the CWB in a number of areas including:

- supplementing CWB marketing efforts through the use of their own extensive global sales networks and direct customer contacts;
- risk mitigation in the form of local market knowledge that the CWB may not have;
- flexibility in logistics such as in the sharing of cargo holds on ships between CWB and non-CWB commodities; and
- provision of market or product expertise in selected markets

In domestic markets the CWB sold wheat and barley directly to companies involved in the milling and malting industries.

During the course of stakeholder consultations it was suggested by some producers and other industry participants that the past practices of the CWB in some markets influenced producer decisions with respect to planting wheat, durum and barley by providing producers with market signals that may not have been present without the involvement of the CWB.

With the passage of *The Marketing Freedom for Grain Farmers Act* the marketing and sale of wheat and barley was made available to all grain companies, grain traders, brokers, processors and marketers, including the new CWB, as is the case with other grains such as oilseeds, processed oilseed products, other cereal grains such as oats and rye, corn, flaxseed and pulses and special crops.

Some producers have suggested that the ability to access the CWB's pooled price was an important factor in production decisions, and that its loss may lead to a decreased interest in wheat and barley production. Others counter with an opposing view, contending that greater predictability of returns will be achieved due to the ability to hedge or to lock in a firm price (i.e. via forward or production contracts), thereby encouraging production of these crops. Nevertheless, the majority of stakeholders consulted believe that a rational analysis of potential market returns will override philosophical positions.

It has been suggested that domestic feed grain production was suppressed in the past. This suppression was said to have manifested itself in two forms: first through the CWB's propensity to focus its marketing efforts mainly on export markets, to what some believed was the exclusion of the domestic market; and secondly by basing certain commodity prices on delivery to port, then backing the price off to a country position. In doing so it was believed that the domestic price was inflated and based on global price structures, as opposed to a local price structure which would have given preference to a domestic market. As such, producers were not incented to grow feed quality wheat or barley, leaving off-grades as the source of feed.

In support of this view stakeholders point to the fact that since August 1, 2012 buyers are asking for varieties such as high-yielding Canada Prairie Spring (CPS) driving up domestic values. When millers are able to get a consistent supply, they are finding CPS wheat more desirable as it fills the overall value package that they are looking for – in terms of both price and quality attributes.

It has been suggested by both producers and grain companies that durum production patterns may change in the future for two reasons. First, they contend that the CWB preferred the eastern gateways of Thunder Bay and the St. Lawrence Seaway for durum exports in order to better manage quality (consolidation, blending and storage) and to lessen pressure on west coast capacity.

Second, some producers believe that the CWB provided artificial supports for durum production in Manitoba – where fusarium is a significant issue – by segregating the affected wheat and offering special programs to producers to blend the affected wheat with sound wheat.

Producers interviewed through the working group consultations believe that in the future durum production will likely move to the southern Prairies and include the eastern points most feasible based on factors influenced by logistical economics. Without the CWB's freight "buffer" farmers will consider the freight spread between durum moving to Thunder Bay and spring wheat moving to the West Coast in their planting decisions which may result in an increase in durum acres in the western portion of the prairies as market and ocean freight realities trigger larger volumes of durum exports being handled via the west coast.

In the post-August 2012 market the planting decisions of producers of all grains will largely be driven by a net financial return per acre/hectare analysis. They will compare projected returns for various grains, oilseeds and special crops given anticipated prices minus all anticipated input costs. Solid financial returns for some newer contenders, especially in Manitoba, are getting farmers' attention. Recent advances in production of soybeans and corn are projected to continue and to expand further as price and demand remain strong and the development of additional varieties suited to Western Canada's climate zones make them strong competitors to traditional crops.

Market Development

Canadian grains and grain products are marketed and sold in a global marketplace in direct competition with comparable products produced in other countries. The marketing of grain is a long-term, ongoing process that includes a number of different activities: market and product development, the development and cultivation of business relationships, identification of customer demand and product needs and the selection of market channels. In global grain markets these activities are undertaken, sometimes jointly, by various stakeholders including government agencies, industry associations and private enterprises.

The development of markets involves addressing issues of value, functionality and suitability from the perspective of processors as well as end consumers. Beyond these foundational issues, commercialization of a market development opportunity must happen within the legal, market and cultural framework of a country—or more commonly—more than one country.

Canadian grain products address peoples' need for food, feed, fiber, and industrial products. Over time, customer demands for specific characteristics of grain products have become more sophisticated. The attributes of products and their effects on nutrition, production processes and aesthetic characteristics can have a strong impact on demand for specific types and grades of grain. For instance the emergence of canola oil as a food ingredient in recent years is based on its presumed health benefits.

The market development process often involves teams of specialists—from two or more organizations—who assemble to create a product or channel that did not previously exist. These teams can include people with expertise in genetics, farm management, grain handling and storage, risk management, accounting, law, finance, and transportation as well as representatives of industry associations or government. The principle objective of the market development team is to achieve "proof of concept" which may include the conducting of pilot projects. Once proof of concept has been achieved and the required approvals have been obtained these development programs are transitioned to commercial operations and become part of the on-going marketing activity of the company.

Maintaining and Building Customer Relationships

Role of Industry Associations

Industry associations provide a means for stakeholders to work together to expand the size of the total export market for Canadian grains and grain products while still competing for their share of the market. Growers, crop input suppliers, grain handling companies, exporters, processors, food and feed manufacturers and governments have a shared interest in being able to profitably grow and market various crops. While all industry associations have a vested interest in contributing to broad market development initiatives they focus principally on issues of production, processing or trade that are specific to the interests of the industry segment they represent. The valuable role that industry associations can play is illustrated through the work of the Canola Council and Flax Council.

The Canola Council of Canada oversees a nine-pronged research program focused on oil nutrition, meal nutrition, crop establishment, crop nutrition, crop protection, harvest management, storage management, integrated crop management, and sustainability to support competitive crop production practices. The Council's Canola Market Access Plan (CMAP) 2015 strategy is a multi-year strategy aimed at improving market access for Canada's canola industry. The strategy includes country specific components that target four major market access issues: approval of genetically modified (GM) events, tariffs, sanitary and phytosanitary regulations, and environmental sustainability regulations.

The Flax Council of Canada is a national organization which promotes Canadian flax and flax products for nutritional and industrial uses in domestic and international markets. In 2009 the Council became actively involved in trying to resolve the suspension imposed on the sale of Canadian flax in Europe resulting from the discovery of CDC Triffid[29] in European food products made with Canadian flaxseed. The Council worked with European Union authorities to establish acceptable protocols for the sampling, testing and documentation of all future shipments.

The Role of Government

Federal and certain provincial governments are active participants in helping identify prospective markets and buyers for Canadian grains, oilseeds, and special crops (field crops). Direct involvement by government in market development can take place in the form of providing contacts, market intelligence, data, education,

[29] CDC Triffid is a genetically modified (GM) variety of flaxseed which contravened the zero tolerance regulations on unapproved genetically modified traits in place in the European Union. Triffid is approved for release in Canada and the US.

and advice. For instance, the Department of Foreign Affairs and International Trade has a network of about 150 trade commissioners internationally for many of whom the promotion and development of the agriculture, food and beverage sectors are important elements of their work.

Governments also participate directly in various areas of research. Agriculture and Agri-food Canada operates 19 research centers across the country. While much of the work—relevant to field crops–involves improving agronomics, research is also done to evaluate the potential for Canadian grains to penetrate foreign markets. AAFC research assesses wheat, barley and oat lines for milling and baking quality, and barley malting quality. They have also studied and reported to industry on the protein and starch contained in cereals, and the physical factors that affect baking, pasta and noodle making, and oat quality.

Through Crown Corporations such as Export Development Canada, government can provide a facilitating mechanism for commercial activity particularly in emerging markets where transactional risks may be more substantial than in more developed and mature markets.

Governments also directly participate in trade facilitation through policy development and assistance in dealing with commercial trade disputes. Canada has a priority of securing rules on trade that maximize transparency and streamline customs procedures. The government monitors the trade remedy laws and practices of Canada's trading partners and may make representations to foreign authorities. Additionally, the government provides Canadian exporters involved in trade remedy investigations with information and advice.

The work of the CGC also enhances the potential for markets to develop by providing "assurance services". The provision of official weights, grades, and other measures is an aspect of Canadian service that has perceived or real value. It should be noted that some private counterparties[30] prefer to adopt bilateral or private third party means of certifying the content of shipments, for new and some existing customers.

Finally, governments participate in market development through international training and technical support programs. As an example, government is involved with the Canadian International Grains Institute (CIGI), which has, since its inception, delivered educational programs to more than 34,000 people—representing field crops industries from 115 countries. CIGI is funded by AAFC and industry partners and provides technical expertise and ongoing technical support to customers around the world. The Canadian government also provides significant contributions and ongoing support to the various commodity councils and industry associations who work in the development of new markets and strategies for Canadian grains in global markets (e.g. The Canola Council of Canada, Pulse Canada)

Role of Private Enterprise

The least visible of all market development efforts involve private stakeholders who confidentially engage "upstream" or "downstream" parties[31], often bilaterally, to create and operate ongoing programs.

Many larger scale end users have some degree of in-house product development and research capability. These firms may have specific product category goals—for instance, to develop a consumer product that confers certain health benefits. The end user may work with a seed developer and/or other supply chain stakeholders to develop an identity preserved system[32] that connects production, through processing, to the ultimate consumable end product for a certain variety that may have value added attributes that may be of commercial interest.

[30] Counterparty is a legal and financial term used to describe the legal entities that are party to a commercial contract.
[31] Refers to other market participants including producers, farm input suppliers, processors and end use customers.
[32] Identity preservation refers to the practices and systems employed in the agricultural sector to track and document the details of products from initial planting through to ultimate sale to the consumer.

An example of this type of market development activity is Dow Agro Sciences Nexera canola. When crushed, Nexera produces "Omega-9" oil, which has a unique combination of high-oleic and low linolenic fatty acids – which are purported to provide heart health benefits. As a result it has been adopted as an ingredient by a number of significant consumer products firms. A number of grain handlers and canola crushers have been authorized by Dow to contract for the sale and production of Nexera by producers.

While this description of market development activities has focused on situations where markets do not currently exist, or are at a very early stage of development (emerging) these processes tend to be equally applicable in developed markets that are advanced in terms of processing infrastructure and consumer per capita income. There are of course exceptions to every rule. Canadian field crops for instance are traded into dozens of countries many of which do not fall into the traditional definition of either developed or emerging. They are characterized by relatively basic processing infrastructure and relatively low per capita income consumers - implying that trade occurs to meet basic needs. In these circumstances, price becomes the highest priority factor driving trade and commercial relationships. In these markets, little or no effort goes into "pilot testing" and "proof of concept". The level of involvement on the part of government and industry associations tends to be infrequent or virtually non-existent.

It has long been a federal government policy to promote Canadian products in both the domestic and international market place. The "branding" of Canadian grain in international markets has been a task undertaken by a variety of stakeholder groups, typically through commodity specific representation such as the Canola Council for canola and Pulse Canada for peas and lentils amongst others. In the case of wheat, durum and barley, in the past the CWB led the approach to the branding of Canadian product through a series of initiatives. In the future this will become a team effort of the whole Canadian grain industry.

The Canadian brand has been a valuable tool when it comes to the marketing of wheat as Canada has long held a reputation in international markets for selling a product that is consistent, and of a higher than average quality. The new CWB will no longer carry the role of promoting the Canadian brand in the same way as in the past. It will be necessary for one or a number of organizations to step forward and take on that role for the industry.

Market Channel Selection

The marketing and sale of Canadian grain and grain products is a key driver of supply chain activities. The selection of markets and market (distribution) channels, the terms of sale including required product attributes, logistics considerations and the timing of delivery will impact all stakeholders in the supply chain. The types and quantities of grain in demand and marketed will influence producers' production decisions, drive infrastructure requirements and operating practices in the grain handling system and establish demand for specific transportation services to move grain and grain products from country origins to consuming markets.

A marketing or distribution channel can be defined as the "pathway" for goods or products to move from their point of production to the end consumer. It is both a physical channel for the movement of the goods from origin to destination and a process channel that includes sales, advertising and the processes around the transfer of ownership of the goods between seller and buyer. Market channels can be as simple as a direct relationship between seller and buyer or more complicated involving multiple intermediaries such as brokers, distributors or retailers.

Logistics Implications of Channel Selection

As is discussed in the following section, there are numerous factors that can influence the selection of one market channel versus another. Whatever the underlying reasons each market channel will directly influence the logistics system required to support the movement of goods between seller and buyer. This will in turn impact the kinds of infrastructure investments to be made by sellers, intermediate service providers and buyers.

For instance large lot bulk sales of individual grains directly from buyer to seller will command different infrastructure and services than will smaller lot sales of specialty grains with identity preservation requirements. Whereas bulk movements such as canola exports require access to bulk country and port terminal storage and handling (e.g. railway hopper cars), smaller lot specialty crop movements may employ completely different logistics systems and often use multiple logistics scenarios depending on the specific customer and in some cases driven by the available capacity of the system.

The Canadian grain logistics system is challenged by the need to integrate the logistics requirements of a variety of market channels used by a large number of sellers that in some instances have very different needs but ultimately must share common infrastructure and capacity in different parts of the system.

Factors Impacting Channel Selection

The selection of a market channel for the sale of grain and grain products will be influenced by a number of factors important to both buyers and sellers. Some important factors weighed by both sellers and buyers in selecting distribution channels include:

Geographic Proximity – From a seller's perspective markets that are local, or nearby, can be easily serviced by smaller firms. Buyers in these markets tend to be easier to identify and cultivate while lot sizes tend to be smaller, transportation less complex and more easily accessible. There tend to be fewer trade barriers and phytosanitary standards are more likely to be low or non-existent making the management of risk easier and easing the administrative burden on the seller. All other things being equal—especially quality—buyers will often favor a local supplier. Effectively managing supply chain risk associated with more distant markets can involve capital expenditures for local storage capacity and increased working capital requirements for inventory management and infrastructure maintenance for both buyers and sellers.

Phytosanitary Standards – Some markets require products to meet a specific base threshold of phytosanitary standards whereas others may require representations on the presence of certain foreign material, or the specific content of adventitious grains.[33] Such standards may be national in nature or commercially negotiated between the parties. Such conditions of sale can increase cost and administrative burdens on the sellers and can present risk for both parties associated with failing to meet the threshold.

Non-Market Considerations – For both buyers and sellers, restraints on the free selection of market channels do not always arise because of some external law but rather can be driven by considerations internal to a company. For instance, some agri-food firms have chosen to vertically integrate or vertically coordinate procurement and processing activities. Joint ventures, strategic alliances, or other informal coordinating practices (e.g. right of first refusal) may cause a buyer or a seller to select one market channel over another.

[33] Adventitious materials are those grains or residues that appear in grain accidentally or by chance.

Risk Tolerance and Mitigation – An important consideration for both parties is the degree of risk associated with the successful completion of sales transactions. Some sellers may see certain markets as more risky than others because they are believed to involve unacceptable financial risk (e.g. destination demurrage) or reputational risks (e.g. the nature and legality of existing business practices within some countries). Buyers will also be concerned with supply and product quality risk. For example a foreign buyer may assess the ability of a Canadian supplier to provide a consistent volume of supply of a consistent quality. Mitigating this risk will prompt some buyers to consider a seller that can offer sourcing flexibility that allows a buyer to source product from an alternative location should problems arise at the principal supply location.

Global Procurement - Increasingly in commerce, buyers operate "global procurement" strategies. A multinational buyer that is manufacturing products for multiple markets may find an advantage in dealing with one seller who has the capability to service plants in multiple countries.

Market Freedom – The extent of government involvement in destination markets, whether through direct participation in trading activities or through the establishment of policies and practices can influence a seller's selection of specific market channels and in some instances preclude their selection altogether.

By way of example, for many years during the last half of the 20th century, many socialist economies granted authority over imports to a central desk buying agency. A number of these agencies preferred to commit to long-term agreements involving large volume purchases over extended time frames. The sizeable capital and risk implicitly involved in being a seller to a central desk buyer favored those who could provide the level of commitment sought—encouraging the participation of central desk sellers and large trading firms capable of originating sizeable tonnages from multiple origins. Selling grain to the Soviet Union for instance was not practically within the capabilities of many small Canadian firms.

There also exist situations where an open economy has developed procedures and practices that preclude a totally free, autonomous relationship between the seller and ultimate end consumer. Some countries have, for instance, embraced policies that provide price support for important agricultural products or ensuring food security. For instance, the Japan Food Agency—and subsequently the Ministry of Agriculture, Forestry, and Fisheries (MAFF)—have had the exclusive right to import rice, wheat, and barley. In practice, this involves the issuance of tenders and many (not all) Canadian exporters have participated in wheat and barley tenders.

Even in so-called open economies where stakeholders have a high degree of freedom to operate - including significant autonomy over terms of trade and product specifications – this freedom is not absolute, and can present a challenge for the seller. For example, for many years the commercialization of canola in the US was restrained by the US Food and Drug Administration's lack of recognition of canola oil as Generally Regarded as Safe (GRAS) even though many US based processors and food manufacturers were extremely interested in its commercialization.

Accordingly, depending on the origin of the product, its destination—and the prevailing legal, marketing and cultural framework—certain market channels naturally arise and are sustained as the "normal course" form of business. It would not be uncommon for a seller of Canadian field crops to participate in several market channels. A firm may be somewhat vertically integrated, and also participate in various tenders, while having a set of longer term bilateral commercial relationships with various brokers and/or consumptive buyers.

Sales and Contract Negotiations

The negotiation of sales agreements and the execution of sales contracts are ongoing activities involving buyers and sellers in both international and domestic markets. Commercial negotiations between buyers and sellers do not happen the same way in all circumstances. Negotiations and the execution of transactions can

be affected by a number of factors including: the level of sophistication that exists in the destination market, the nature and rigour of purchaser product specifications and the volume of product being sold. In the past the type of grain, specifically whether or not it fell under the purview of the CWB, could also be a factor.

In spite of these differences certain elements of the sales process are common to all sales, specifically the mechanics of commercial settlements and terms of sale provisions.

Terms of Sale

The commercial grain trade is generally considered to be a "cash business"[34], whereby the purchaser is expected to pay for the product, in cash, at the moment where title of the product changes hands. This can be accomplished in several ways. The simplest and most cost effective approach generally occurs between counterparties that have long standing relations. In these cases the seller will issue the purchaser an invoice who upon receipt, will wire transfer the funds forthwith. A more complex and costly mechanism involves the purchaser setting up an irrevocable Letter of Credit at a bank satisfactory to the seller – a service for which the bank is paid a fee representing a small percentage of the transaction value. Once the bank notifies the seller that the Letter of Credit is in place and the seller provides completed documents showing performance as per the terms of the contract the money is transferred to the seller.

Grain sales in Canada generally conform to the frameworks established by one of two major international associations - the Grain and Feed Trade Association (GAFTA) or the North America Export Grain Trade Association (NAEGA). Most international forward and physical contracts are entered into months ahead of harvest, shipment, or delivery. It is critical therefore that parties can rely on accepted, standardized terms of sale and know that should a problem occur there exists an agreed upon process to find a remedy. While NAEGA coordinates and aligns much of its efforts with GAFTA, it also maintains a model contract for Free on Board (FOB) transactions at US ports and provides ancillary arbitration and related services.

While historically the CWB had limited involvement in vessel freight - that is its sales were transacted primarily on an FOB basis - in recent years it has sold more and more grain on a cost and freight (C&F) or cost, insurance and freight (CIF) basis where it chartered the vessels and was responsible for ocean freight costs. There are two fundamental reasons for any buyer or seller of export grains to want control over their ocean vessel movement. First is the ability to control the logistics as it provides greater control over sourcing and ultimately the planning of vessel loading activities. Secondly, control of the commercial terms of the ocean vessel provides the ability to arbitrage price. Ocean vessel prices have been consistently low for over four years with available capacity exceeding demand. As such, the opportunity for significant improvements in margin has existed for any entity that controls the ocean freight.

Domestic canola crushers who do not have their own integrated origination capability can purchase product for delivery to the crush plant by truck or rail although truck is the dominant mode of transport for these movements. Integrated companies that own both country elevator assets and crushing operations bid for farmers' canola and then structure and organize delivery to optimize overall truck and rail freight. The offers made by grain companies to farmers for canola are structured the same regardless of whether the end market is within Canada or not.

[34] A distinction must be made between products that trade commercially versus products that trade (or are shipped) for non-commercial reasons. For instance, food aid does not happen due to a commercial relationship. At times, Government has been amenable to providing offering some form of credit to particular purchasers. The discussion of the sales process excludes consideration of non-commercial situations.

Contract Execution

The C&F/ CIF terms of sale requires the exporting company to secure vessel freight. The vessel freight market trades through a network of brokers. It is conceivable the exporter may have pre-booked freight based on their expectation of a sale and their view of the freight market at the time. Alternatively the exporter may have booked a vessel on a "time-charter"[35] or not at all in which case he will look to the "re-let" market if it appears others may have surplus freight, relative to what was expected as demand for freight.

At some point in time the exporter will secure a vessel nomination, i.e. the exporter will be able to indicate to others both inside and outside the company (e.g. a railway), the name and estimated time of arrival (ETA) of the vessel for operational planning purposes. Vessels arriving at Canadian ports require inspection for security and phytosanitary reasons. Once the vessel passes inspection, and indicates its readiness to load, it is considered to have "presented". As will be described in a following section outlining the order fulfillment process, operations, merchandisers and logistics team members of the exporter will have arranged for the required volume to be commercially cleaned and ready for loading. Most sales contracts will include terms that call for the purchaser to provide an irrevocable Letter of Credit, and the exporter will track its status[36].

Presuming the Letter of Credit is in place, vessel loading begins. As the stevedoring team directs the grain, the Canadian Grain Commission collects samples and will ultimately provide a certificate attesting to the weight and grade of the product. The contract may call for a certain volume "plus or minus" a percentage. Or the contract may be for "min/max", i.e. an absolute amount of tonnes—in this circumstance there will have been an understanding struck between the exporter and purchaser as to how to price amounts above/below the contract—generally speaking the exporter wants to ship as close to the contract quantity as possible, as he is responsible for "dead freight" (empty space). If loading is done efficiently and expeditiously, the exporter may earn "dispatch" from the vessel owner, which is a payment made if the exporter completes vessel loading in less than the contracted/expected time. Conversely, if vessel loading is delayed for reasons deemed to be controllable by the exporter, (heavy rainfall is generally excluded) the exporter may incur demurrage.

When vessel loading is complete, a manifest containing all of the documents required under the terms of the contract is prepared. The manifest is presented to the bank holding the Letter of Credit. If all is in order, the money is released and the vessel is given clearance to depart.

Sustaining Markets

Canada's grain buying customers are important to all stakeholders of the country's grain supply chains. The mechanisms for maintaining customers vary as widely as the number of customers themselves. For example the merchandising of field crops is sometimes referred to as "a commodity business" implying that it is very much a price driven business that does not command enduring customer loyalty or require long-term customer relationship management on the part of sellers. However, many look at Canada's grain products as carrying a quality "brand" for which premiums can be raised.

In some cases, Canada's grain products are sold on a commodity basis. There are several foreign customers who simply want a basic product, and purchase through a tender process for product that may originate from any number of countries such as Canada, the US, Australia, Argentina, or Russia as the buyer is virtually ambivalent as to the source. They are looking for the lowest cost product to meet a basic set of criteria (i.e. a base milling standard, or simply as a protein additive).

[35] Essentially a way of renting a vessel for a period of time to shuttle between two or more destinations

[36] The credit relationship between buyers and sellers of grain is dependent on the relationship of the companies. Some buyers will have long term relationships with the seller that see established terms of payment, where others require one time establishment of credit terms through a bank issued letter of credit.

In many more cases, customer relations are crucial. In some cultures, personal contact is considered essential. Grain, oilseed and special crops transactions involve millions of dollars, and material contract terms are agreed upon over the phone, perhaps with someone on the other side of the world. Trust is a critical element of the relationship, and often personal negotiations are the only way to agree to the structure of a relationship. Whether trade is FOB or C&F/ CIF, for instance, may necessitate a face to face, high level conversation and trade-offs between the parties. Customers located in regions where local production is scarce or non-existent may also derive comfort from a face to face assurance that their supply needs will be met.

Industry conventions provide a convenient means for people from various parts of the world to network. Over and above this are commodity specific meetings. For about forty years, the Canadian canola industry has engaged Japanese customers and importers via Canola Council "pre-consultations" and consultations. Trade missions also provide a vehicle for parties to discuss shared problems, ongoing bilateral challenges, and future opportunities. Finally, bilateral visits by exporters to customers—or vice versa—are generally much appreciated. These visits often include operational tours that provide insight on the operating challenges of the parties. All of the above absorb significant amounts of time of senior teams across many companies and associations, as well as government and supporting agencies.

Summary

Marketers of Canadian grain are primarily price takers in the global markets. The exception is where millers in some markets look to Canada to supply a superior and consistent product with attributes that meet distinct specifications. An example of this is Canadian wheat sold to Warburton's bakeries in Great Britain.

The structure of the Canadian market is typical of most commodity sellers in that it looks to link sellers with buyers through the whole supply chain – from producer to the end user. That structure has evolved in the past two years since the elimination of the Wheat Board's single desk. This has had an impact on all supply chain participants:

- Producers must manage all of their market relations with buyers, who are predominantly the line grain companies with country elevator facilities capable of buying, elevating and loading grain to rail cars.
- Grain companies now have full control of the marketing of cereal grains and complete control of their assets.
- Market development activities related to wheat, durum and barley that were previously managed by the Canadian Wheat Board now rest entirely with the grain companies, with support from various government and non government entities, such as the Canadian International Grains Institute, the Canadian Grain Commission, Agriculture and Agri-Food Canada and various industry and commodity trade associations.

The greatest challenge faced by the marketers of Canadian grains has been and will continue to be the matching of sales volumes to the available logistics capacity. Canadian marketers of grain must base all sales plans on the transportation options they can secure from point of origin to final destination. The major determinate mode is rail as over 95% of all Canadian grains for export must move to the export position on one or the other Canadian railway. The logistics portion of the supply chain is discussed in the following section of this report.

The Canadian Grain Logistics System

The logistical challenges of moving grain to export position faced by Canadian grain exporters is like no other country competing in the global grain markets. A separation of over 1,500 kilometers on average in addition to some of the most challenging climatic and geographic conditions requires that Canada must have an

efficient and reliable connection between the country elevator system and tidewater ports in order to effectively compete. As such, the processes and activities that facilitate the movement of grain from producers to the final consumers require a high degree of integrated planning and operations across all stakeholder groups. The primary logistics processes for the various grains and grain products shipped in Canada are described in this section of the report. In reviewing these processes we explore the current approaches as known today and make note where processes have changed as a consequence of the elimination of the Canadian Wheat Board's marketing monopoly.

The Canadian grain logistics system as discussed in this report views the movement of grain from the farm gate to the point of export as well as the processes involved in the securing and contracting of ocean freight for movement to final destination. In the narrative that follows we discuss how the importance of export markets to Canadian grain producers, compounded by Canada's geography and distance from markets, places particular importance on the performance of supply chain partners to ensure reliability of supply to customers. Critical in this regard is the performance of the logistics system particularly the railways, which handle 95% of all export grain traffic, and the port terminals where capacity constraints dictate the need for efficient inventory and pipeline management practices.

Grain Production and Delivery

The roles of the producer, marketer, logistics provider and buyer blend in the search for the right mix of mode and route, origin and destination, product and characteristic that delivers the optimal profit margin for the seller and greatest value for the buyer. As the stakeholder at the beginning of the Canadian grain supply chain, Canadian grain producers make annual crop production decisions based on a number of factors including market demand signals, cost, production and market risk and land stewardship requirements. These decisions are not without risk as there can be as much as six or more months between the time inputs are purchased, and when seeding and harvest are complete. Much can happen to price and the global market in that time frame.

Generally speaking, most producers will look to seed the crops for which they possess the technical expertise, for which their land and climatic conditions are suitable and which they believe will provide the greatest financial return with the lowest acceptable cost and risk.

As such annual grain production – including quantity, quality and timing of harvest - and the decisions and actions of grain producers can be important determinants of the activities of other supply chain participants such as railways and grain companies. The volume of grain produced along with its quality and the timing of its availability relative to expectations or plans can directly influence how grain is marketed, priced and sold. It will also influence the infrastructure, capacity and operational requirements of the system for the storage, handling and movement of grain to market.

The type of grain, the relative volume of individual grades within a grain type and how they are marketed will influence how grain is transported and handled in the elevator and terminal systems. For instance, grade segregation and the type of grain can influence the capacity of port terminal elevators while the logistical routing and port will influence the demand and capacity requirements for physical railway assets dependent on the length of haul and seasonality of the movement.

While the processes and activities can differ based on the type of grain and the market to which it is destined, in general there are common processes that must be coordinated for the supply chains to work effectively. For export movements, these processes are: sales, grain sourcing, inland transportation, and port and ocean activities. For domestic sales the processes are similar but they do not require the coordination of inland and ocean logistics activities. Where grain must be processed before sale, production planning processes must also be considered.

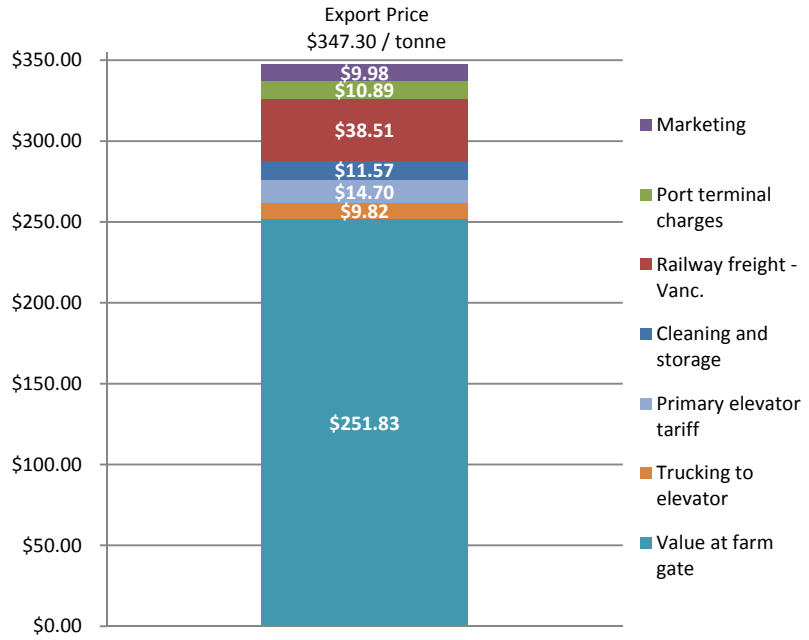
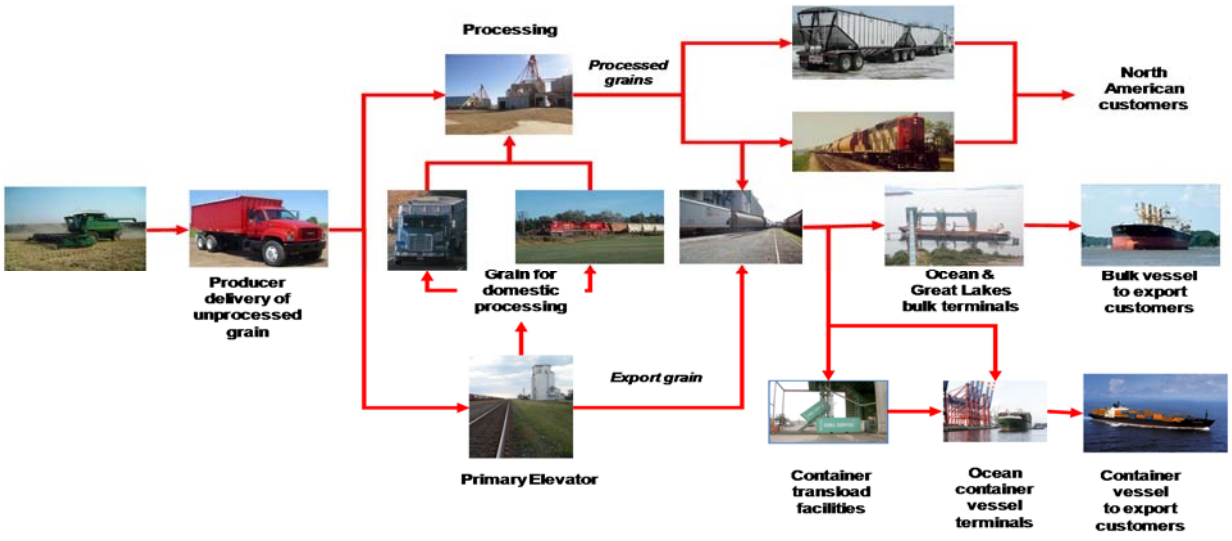


Figure 11: Handling Costs of grain (example is 1CWRS)

For the producer and exporter, the logistics of moving grain to export position is not only a critical part of the supply chain from the perspective of service, it is also a major component of the cost base, with some 20 – 25% of the landed cost at port being consumed by a combination of rail freight, and handling costs in the country and at port (see Figure 11 above). In this example the export price of the wheat is $347.30 per tonne. The total logistics costs which include trucking, inland elevation, rail transportation, port costs and marketing costs make up a total of $95.47. As the farmer is a price taker, having no influence over world grain prices, his gross return on the sale would be $251.83. In a year where world prices are higher - to the extent that the logistics cost elements are not responsive to world prices, the producer's return will be higher and they will similarly suffer when prices are lower.

Canadian grain producers have responded to changing market demand for grain and grain products during the last twenty years, changes that carry significant implications for supply chain activities from the terms under which grain is sold through to the kinds of physical assets and management practices necessary to support the movement of grain to meet customer requirements.

Figure 12: Summary view of the Canadian grain logistics supply chain



Key Participants

There are many participants in Canada's grain supply chains. Supply chain participants can be classified into four broad categories based on their activities or roles within the supply chain: production, transportation and logistics, market participants and government and government agencies. The processes and activities that facilitate the movement of grain from producers to consumers require a high degree of integrated planning and operations across all stakeholder groups.

Producers: As the beginning of both the supply chain and the logistics chain, they produce and sell grain to other market participants, specifically grain companies and grain processors. With an estimated 30,000 grain producers on the Canadian prairies, they manage the storage and local logistics for the movement of grain from farm to the primary elevator system.

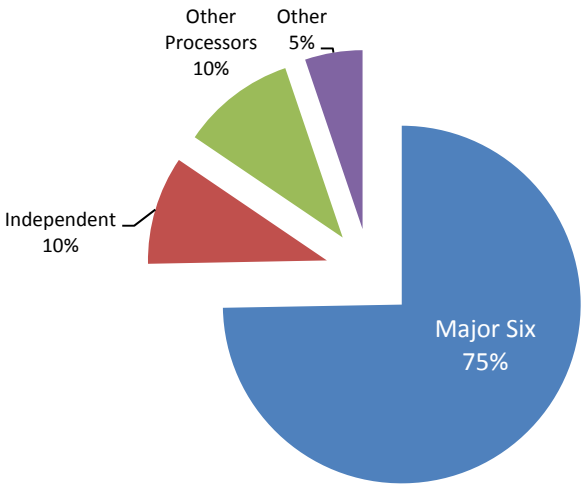
Trucking: Grain is almost always delivered by truck to a primary elevator or a processing facility. From there it can move via rail or truck either directly to customers or to terminals and facilities for loading to bulk and container vessels for shipment to overseas customers.

Primary and process elevators: In Canada's grain supply chain, the country elevator network no longer plays just a warehousing function but now lies at the centre of the grain sourcing and procurement process. Now more than ever elevator management is playing a critical role in the facilitation and maintenance of the relationship between a grain company and the producer. They purchase grain from producers and provide the logistics services to handle grain at primary and terminal elevators. Grain companies market grain to processors in North American and export markets. They may also be involved in the supply of producer inputs such as fertilizers, seed, pesticides and fuels.

Grain purchasers and processors purchase Canadian grain for use as food, animal feeds, processed products, fuels, and industrial uses.

Like all major processes within the grain logistics system, the attraction of grain into the processors' facilities must be coordinated with the activities of stakeholder partners that provide capacity for downstream components of the logistics stream. There are presently 391 licensed primary and process elevators, in 274 towns and cities with the storage capability of 6.85 million metric tonnes of grain. As shown in Figure 13, there are 6 major grain companies that hold 246 of the elevators (63%) with 75% of the total storage capacity and 76 companies operating the remaining 145 facilities (37%) with 25% of the storage capacity.(see Appendix 5 for a detailed summary of elevators and ownership)

Figure 13: Western Canada Licensed Elevator Storage Capacity



Railways: Provide transportation services for grain and processed grain products direct to North American customers and to ports for export. Rail car supply performance problems can complicate both primary and terminal elevator planning when cars are not available to move stocks that are required to meet sales commitments at ports. Capacity and market signals are important to grain companies in order to draw the right grain into their facilities in advance of receiving cars for shipment. This involves both indications from the railways as to what car supply will be available and information regarding commodity demand.

There are two major (Class 1) railways in Canada – Canadian National and Canadian Pacific – who operate 14,907 miles of track in Western Canada. In addition, there are 18 shortline railways serving the grain industry in Western Canada who operate 2,693 miles of track.

Port Bulk Terminals: The majority of grain exported from Canada moves through the bulk terminals located at 4 ports in Western Canada and 13 ports in Eastern Canada. The bulk terminals serve a number of purposes: to receive grain from rail and truck; to grade, segregate and store grains by type and quality attribute; to clean grain when required; to blend and load grain to ocean vessels (and lake vessels in the case of terminals located on the Upper Seaway) based on the instructions from the marketer and on the terms of the individual sale.

Most port terminals in Canada are owned and operated by grain companies who market their own grain. In most cases they offer their surplus capacity to other grain companies who do not own port terminal capacity. Of the 29 port terminal facilities in Canada (16 in Western Canada and 13 in Eastern Canada), only 4 are not operated by entities who market grain. See Table 6 for a summary listing of Canadian Port Terminals.

Containers: An option that has become more popular in the past 10 years sees product loaded into sea containers that move directly to the end use customer. This provides an ideal vessel for both transit and storage, albeit at a higher cost in most instances. This mode is conducive to those moving smaller lot shipments or to buyers with limited storage or constrained access.

	Storage Capacity	Facilities
Western Canada		
Vancouver	891,240	6
Prince Rupert	209,510	1
Churchill	140,020	1
Thunder Bay	1,157,240	7
	2,398,010	15
Other Ontario Terminals		
Goderich	140,020	1
Hamilton	93,800	2
Owen Sound	106,420	1
Prescott	174,020	1
Sarnia	151,000	1
	665,260	6
Lower St Lawrence		
Quebec City	224,030	1
Baie Comeau	441,780	1
Montreal	262,000	1
Sorel-Tracey	146,460	1
Trois Rivieres	109,000	1
Port Cartier	292,950	1
	1,476,220	6
Maritimes		
Halifax	135,810	1
	135,810	1
Total	4,675,300	28

Table 6: Licensed Storage Capacity - Canadian Port Terminals (Source - CGC)

Transloaders: They provide the services to transload grain from inland transportation systems such as bulk rail, truck or intermodal into ocean containers for export via ocean vessels. Working together with the shipper and the shipping line, the container bookings are confirmed, the grain is loaded to the container and the container delivered to the container terminal where it is loaded to the ocean vessel. There are five terminals in Vancouver, three in Montreal and one in Halifax.

Ship Brokers and Agents: The role of the broker or agent is to contract with single or multiple grain buyers and sellers for the provision of ocean freight services from vessel owners. There are hundreds of ship brokers and shipping agents across Canada. Many are part of or affiliated with international companies and third party logistics providers (i.e. Kuene and Nagel, Schenker) while others will represent one or more of the Vessel owner/ operator (i.e. Hamburg Sud). There are also several well established independent agent/ brokers who provide this service to both the seller and buyers of grain.

Vessel owners and operators: There are hundreds of bulk vessel owners and operators around the world who provide vessels used in international trade of grain and grain products and for the movement of grains within the St. Lawrence Seaway system. Often working through shipping agents or brokers, they sell their service for the movement of commodities from Canada to port destinations around the globe.

Government & Government Agencies

Port Authorities: Local port authorities coordinate the operation of vessels in and out of Canadian ports and coordination planning and commercial development activities at the ports.

The Canadian Grain Commission: The CGC certifies the quality and safety of Canadian grain through their inspections services. They conduct research on grain quality, license facilities and protect producers' rights to deliver grain into the elevator system. They also administer the car orders that allow producers to directly load and ship rail cars (producer cars).

Transport Canada: There are several functions within Transport Canada that touch the grain supply chain, from the country to the port. In addition to rail safety, the department develops rail transportation policies and legislation to ensure Canada's rail industry supports the Canadian economy and shippers. At the port, the department provides marine regulatory oversight and, more specifically, inspects ocean vessels prior to loading. The Canadian Transportation Agency, as the regulator of the industry, works at arm's length from the department to administer the provisions of the *Canada Transportation Act*. As a quasi-judicial tribunal, the Agency also works with shippers and railways to resolve a range of transportation issues, informally and through formal adjudication related to rates and service delivery.

Agriculture and Agri-Food Canada (AAFC): It is the mandate of AAFC to support the current operation and long term growth initiatives of Canada's grain supply chains through the development of policy and regulations to protect the interests of individual stakeholders while enhancing supply chain competitiveness in global markets. In addition, the Government of Canada manages several ongoing programs and initiatives that support the marketing efforts of the Canadian grain industry.

The Canadian Food Inspection Agency (CFIA): Vessels arriving from certain countries where insect and fungal infestations are a threat to the Canadian agricultural environment must be inspected and certified clear by CFIA inspectors. In addition, many of the sales made of Canadian grains are to countries whose phytosanitary regulations require that a recognized government food inspection agency such as the CFIA inspect and certify that the product meets health and phytosanitary conditions and are in accordance with Canadian regulations.

Railway Operations

The average railway loaded transit time for grain moving between primary and port terminal elevators in Western Canada was 6 days during the 2010-11crop year.[37] The grain monitor also calculates a coefficient of variation of transit time which expresses the standard deviation of the variation of transit time as a percentage of the average. This is the GMP's measure of service variability and reliability. For the 2010-11 crop year that variation was 30.8%. Statistically, this means that the average grain shipper moving grain between a single origin and single destination, would expect their transit time to vary between 4 and 9 days for approximately 80% of the rail cars shipped with the remaining 20% of shipments falling outside that range.[38] This variability of performance in the rail system requires port terminal operators to be able to absorb and react to variations in railway performance and to deal with uneven demands for rail car unloading at their facilities. This flexibility can be compromised if the terminal is already congested by performance or planning issues that limit the availability of storage or ship loading capacity in the port terminal.

[37] Monitoring the Canadian Grain Handling and Transportation System. Annual Report 2010-2011 crop year. Quorum Corporation
[38] This calculation is based on the assumption that the distribution of transit times is normally distributed but with a slight shift to towards more of the trips having longer than average times as opposed to shorter than average times.

Rail car supply performance problems can complicate both primary and terminal elevator planning when cars are not available to move stocks that are required to meet sales commitments at ports. Capacity and market signals are important to grain companies in order to draw the right grain into their facilities in advance of receiving cars for shipment. This involves both indications from the railways as to what car supply will be available and information regarding commodity demand for their needs.

There is currently no comprehensive independent data on the performance of Canada's railways with respect to car order fulfillment. Most recently, as part of the Rail Freight Service Review undertaken by the federal government in 2008, a quantitative assessment was done of railway performance with respect to the supply of empty cars. The analysis examined performance for the two year period from October 2006 to September 2008 and found that in the aggregate railways supply more than 97% of all hopper cars ordered by grain shippers. However, on a week to week basis there was significant variability in performance with both railways only providing grain shippers with 90% of the cars they ordered at a given location 50% of the time.

During the period of this study, grain shippers publicly acknowledged that railway order fulfillment performance generally improved over the period of the Service Review. However, shippers have complained that there is still significant performance variability for certain fleets – i.e. boxcars for pulse and special crops shippers – and that recovery from operating disruptions caused by weather or other railway operations issues can cause periods of extended disruption to supply. It should be noted that as part of this examination, empty rail car supply performance information was requested from the railways and was not available.

Car Allocation and Order Processes

In today's open order process, the coordination of grains flowing into and out of the country network is under the control of the owning grain company. In order to plan and execute the movement of grain products from primary elevators to destination (be that ports or direct to a domestic customer) railways rely on forecasted demand information from the grain companies. Grain companies provide their rail car orders to railways from 1 week to a few months in advance of their desired shipping day. Shippers will order cars for a particular origin location and for a particular destination corridor to be placed for loading within a given 7 day Sunday-Saturday period known as a grain week.

Both CN and CP utilize an internet based open order book to receive car orders from grain companies allowing shippers to place origin-specific car orders with "want dates" up to 16 weeks in the future for CN and 17 weeks for CP. Notwithstanding these four month availability windows, both carriers indicate that most orders are currently being placed with a maximum of two to three weeks lead time.

Under the open order process offered by both railways, orders must be placed no later than Tuesday of the week prior to the week for which cars are ordered. Both railways communicate a supply plan to shippers by the end of Friday of the week prior to the planned service date and they attempt to provide updates to any last minute changes to loading plans during the week as changes occur due to railway operational issues.

When determining how they will allocate its available car supply, a railway will be guided by a number of factors. Predominant amongst these is the need to ensure that the terminal or receiving facility is capable of accepting and unloading the cars requested by a shipper. Therefore the railways will closely monitor the unloading capacity, inventory status and "pipeline" of cars en route to a terminal to ensure they do not place more cars for loading than the rail system and destination terminal can handle in the planning period. Ensuring that sufficient empty car supply is available for loading at primary elevators will be largely determined by preventing congestion, delays and maximizing unloads at ports. Beyond seeking to manage possible congestion issues, railways will allocate available car supply based on customers' previous performance in the use of allocated rail equipment, and they may ration cars in periods of high demand based

upon shippers' historical percentages of overall demand. Orders that have not been filled in previous periods will usually have a higher priority than new orders as well.

Producer Cars

Producers also have the option to load and ship their own product by making an application to the Canadian Grain Commission (CGC) who is responsible for the administration of producer cars. The CGC charges a handling fee of $26.50/rail car for the administration of the application. It is incumbent upon the producer to supply proof to the CGC that they have a sale (or destination) for the grain they intend to load in the producer car.

A producer can assume the responsibility for the administration of the producer car or they can hire another party to do so for a fee. Those involved in providing the administration services can be producer loading cooperatives (e.g. West Central Road and Rail or Great Western Railway) or an independent terminal operator (e.g. Southwest Terminals or Great Sandhills Terminal).

A critical step in the process is the establishment of a buyer for the grain to be shipped. All grain for movement requires the producer to consummate a sale and obtain the authorization of the destination terminal or consignee to ship the goods. Today, if the grain is not contracted to the CWB, the responsibility of doing so is incumbent upon the producer shipping the grain. When the application is approved, the CGC will notify both the producer and railway. The railway will advise the producer of the spotting date of the car. It is the producer's obligation to ensure the car is loaded in a timely fashion and that a bill of lading with shipping instructions is completed and submitted to the railway. There are presently 366 producer loading sites in Western Canada, 234 on CN and CP and 132 located on shortlines.

The change in the CWB's mandate effective August 1, 2012 has changed the transportation environment for producer car shippers. Because the producer requires a means through which to market the grain moved in a producer car, producer cars historically moved wheat and barley and relied almost exclusively on the CWB, which marketed over 95% of producer cars loaded in Western Canada. The remaining 5% was devoted primarily to the movement of oats into the American market. The post single desk process requires producers to find their own marketing channels prior to ordering a producer car. The CWB continues to use producer cars as a key sourcing opportunity for the grain it markets.

Equally important to producers was the ability of the CWB to minimize a producer's risk exposure through its ability to absorb a producer car mis-grade through blending with other product at the port terminal – a strategy made possible by virtue of the CWB's control of all wheat and barley flowing through a terminal. Going forward, the new CWB has been clear in its communication with producers that it will no longer be able to continue this practice. This means that producers will now assume a greater proportion of the risk associated with producer car shipments including being responsible for shipping costs, all costs related to the risk of loss, ensuring the accurate reporting of the contents of a car and all risk associated with the grade and quality of the product. Despite that risk, producer cars have continued to enjoy a level of popularity with producers as a means of marketing their product, with almost 4% of grain producers continuing to use this marketing channel.

Shortlines

Shortline railways have become an integral part of the producer loading network in Western Canada. The impetus for the development of the shortline industry in Canada was the decision of Class 1 railways to reduce the size of their networks and in some cases to lower the operating costs on lines with low traffic density. Early railway network rationalization efforts in the 1990's resulted in a number of sales being concluded between CN and CP and existing shortline railway operating companies that served as operating

agents of their former Class 1 owners with CN and CP generally handling most of the marketing, rate setting and interline railway business support processes on behalf of the shortline.

An important trend in the western Canadian shortline industry has been the move by producer groups to purchase railway lines for the explicit purpose of supporting producer loading initiatives.

Many of these shortlines commenced operations with a high proportion of their business based on grain shipments. However, as the grain companies pushed forward with their own network rationalization plans and shut down grain delivery points on these lines the underlying economics of the shortlines were compromised. In some cases the shortline companies ceased operations and the rail lines were abandoned. In other cases CN and CP have repurchased their previously divested lines and invested capital to upgrade them – particularly lines in Northern Alberta that support increasing bulk resource shipments and oil sands related development.

An important trend in the Western Canadian shortline industry has been the move by producer groups to purchase railway lines for the explicit purpose of supporting producer loading initiatives. The means by which these groups use shortline railways to support their producer loading operations has evolved. In some cases, particularly in southern Saskatchewan, shortlines have diversified their business into non grain markets by providing services for crude oil transloading and transportation, fertilizer and other industrial products[39]. Appendix 6 shows a map that displays the western Canadian rail network identifying the location of shortline railways.

In recent years, over 80% of grain that has originated on shortlines has been wheat and barley that was marketed through the CWB. Most stakeholders believe that for shortlines to continue to prosper in grain markets going forward, they will need to diversify their business model to utilize marketing channels in addition to whatever continuing interest the new CWB will have in producer loading of rail cars.

Ports and Port Terminals

Canada has twenty-nine port terminal facilities at sixteen separate ports from Prince Rupert, British Columbia to Halifax, Nova Scotia and as far north as Churchill, Manitoba. The port terminal network provides a secondary warehousing role within the supply chain as bulk grains are stored in these terminals awaiting loading and dispatching of ocean vessels at the point of export. The utilization, volumes, manner in which they operate and the relationship they have with the port varies from port to port. While these variations are distinctive, typically port terminals are viewed in terms of their eastern and western geographic situation. This has much to do with the fact that Western Canadian grain falls under special regulatory provisions in the *Canada Transportation Act*. A map of the Western Canadian Port locations and the rail network can be found in Appendix 8.

The St. Lawrence Seaway is the largest inland waterway in the world and is the predominant method of moving grain to eastern Canadian ports. It is comprised of 15 locks between Montreal and Lake Huron capable of moving deep draft vessels. A map of the Eastern Canadian rail and port network can be seen in Appendix 9.

[39] Saskatchewan is unique in that the Provincial Government provides a higher level of support for short line railways in its assistance for capital investment.

Port Terminal Elevator and Bulk Vessel Operations

Grain shipped to a port terminal elevator must go through all of the following processes:

- Rail car receiving and unloading;
- Elevation into scaling (weighing) and storage;
- Transfer from storage to shipping bins;
- Scaling and ship loading.

In addition to these steps, some grain will go through one or more of the following additional processes: cleaning; drying; blending; and fumigation.

The rail car receiving areas of Canada's port terminals have protection to allow all-weather receiving of rail cars and grain flows from the receiving pits via conveyor to an elevation system (receiving leg) which elevates the grain to the top of the elevator complex where the grain can be scaled, sampled, and directed via spouts and conveyor systems either directly to storage bins or to cleaning or drying bins and facilities.

The port terminal system is a vulnerable element of the supply chain. This is because Canada's port terminals – particularly those on the west coast - are highly utilized and therefore have high throughput to storage ratios as compared to the country elevator system. Table 7 illustrates the ratio of grain throughput to storage (turnover) for the primary and port terminal elevators in Western Canada.

(000's of tonnes)

2011/12 throughput		Storage Capacity		Turnover Ratio	
Primary	**Port**	**Primary**	**Port**	**Primary**	**Port**
35,339	26,897	5,964	2,214	6.0	11.1

Table 7: Elevator throughput and storage - Western Canada (Source: Monitoring the Canadian Grain Handling and Transportation System Annual Report 2011-2012 crop year, Quorum Corporation)

It is important to note that some Western Canadian port terminals have throughput ratios that are nearly twice as high as the corresponding primary elevators that handle the grain destined to the ports. However, these summary statistics understate the much higher than average utilization of the west coast elevators at Vancouver and Prince Rupert which had turnover ratios of 16 and 23 respectively in crop year 2011/12. These high rates of utilization were in contrast to the rates for elevators in Churchill and Thunder Bay which had ratios of 4.7 and 4.6 respectively.

The throughput capacity of the bulk port terminals must also be viewed with respect to the average volume loading of cargo vessels. As is noted elsewhere in this report, the average operating storage of the most highly utilized west coast terminals ranges from approximately 90,000 tonnes for the smaller terminals to up to 225,000 tonnes at the largest terminals. The average bulk grain vessel loaded 34,000 tonnes at Vancouver and 46,000 tonnes at Prince Rupert in 2010.[40] At Vancouver the average vessel would therefore represent from 15% to 38% of a terminal's total operating capacity and at Prince Rupert the proportion is 27%. In a period of normal port operations, the average vessel spends a total of 3-4 days at berth on average to load depending primarily on vessel size and weather conditions.

[40] Canadian Port Clearance Association and the Prince Rupert Port Authority

In recent years, marketing efforts, increased sensitivity to food security and health issues as well as buyer demand have increased the need for additional segregations of grain. These changes include:

- An increasing diversification of crops produced for export and handled through the system
  - An increase in the level of precision with respect to the terms of sale for Board grains particularly as regards the differentiation of protein content for wheat sales
- Increasing instances of market restrictions and requirements for testing for phytosanitary issues as has recently been experienced with flax shipments to Europe.

These trends towards increasing segregations of grain can act to increase the complexity – and in the absence of effective coordination of logistics – reduce the throughput capacity of the system leading to increasing instances of congestion and a requirement for additional port terminal capacity to maintain supply chain fluidity.

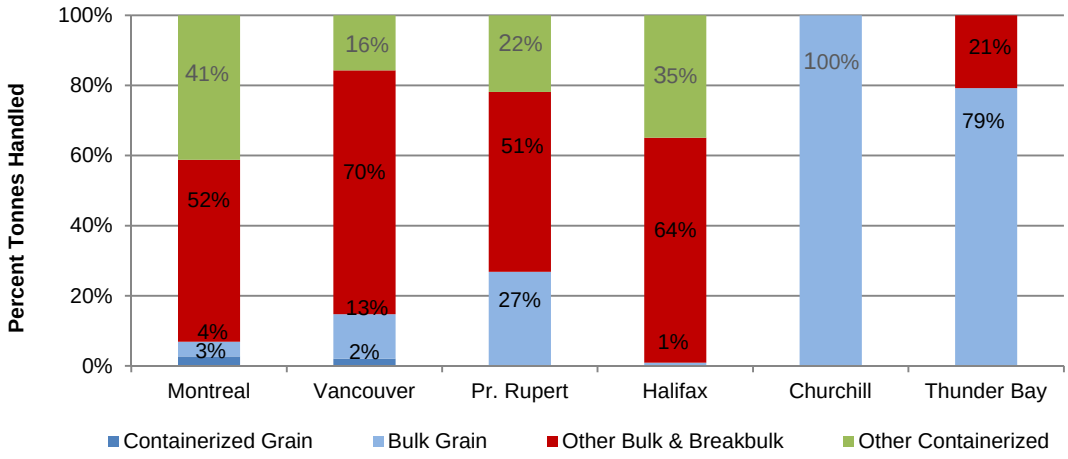


Figure 14: Grain as a proportion of total port activity (2010 -11 Crop year)

Other possible disruptions to port operations include delays to loading caused by excessive wind or rain and the requirement for all vessels to pass inspection by Transport Canada and Canadian Food Inspection Agency personnel for safety and phytosanitary reasons prior to being cleared for movement to a loading berth.

It is important to note the role that grain plays in the utilization of Canada's major port resources. Grain in both bulk and containerized form makes up a large proportion of the total throughput of the four Western Canadian ports that handle grain. While bulk grain exports do not share terminal facilities with other commodities – as grain moves through terminals that handle only grain - it does share the railway infrastructure, anchorage and pilotage resources required to run these ports. As with mainline rail infrastructure, the coordination of the demands of multiple commodities and port operations will sometimes restrict the flexibility of any specific port user in responding to short-term fluctuations in operational demands. It is important to note that many exporters will not manage their own vessel chartering but will deal with ship brokers who manage this on their behalf.

Charter agreements will generally specify the type and capacity of the vessel required, the origin and destination ports and any conditions with respect to the specific needs of the commodity being shipped. The agreement may not be for a specific vessel – but for a vessel that meets the specifications in the contract. In addition, the contracted arrival window of the vessel at the loading port will customarily be approximately 14 days, reflecting the variability of loading and transit times of bulk vessels. The identification of the actual

vessel for a charter contract may occur at the time the contract is executed or only days before its arrival at port.

Containerized Shipments of Grain Products

The use of containers in the movement of export grain from Canada has grown considerably in recent years. From virtually no containerized grain movement into export overseas markets in 1999, it has grown to represent almost 13% of total grain exports in the 2010 -11 crop year. Of the 3.3 million metric tonnes moved in 2010-11, approximately 60% is made up of pulse and special crops with smaller but still significant volumes of malt, hay and distillers dried grains. (See Figure 14)

For shippers of grain products in containers there are similar constraints and interdependencies between marketing and logistics systems as seen in bulk movements. The availability of inland transportation capacity by rail, the limited storage and throughput capacity of transloaders at the ports and the reliance of the entire system on the efficiency of port container terminals are reviewed below.

Containerized shipments of grain are used predominantly in sales for which receivers do not have the capability of handling bulk shipments, for shipments of products that are sensitive to bulk handling or are bagged and/or shipped in small volumes.

The use of containers became popular during the economic boom of the early to mid 2000's when container freight costs were falling and bulk ocean rates rising. With an abundance of empty containers moving from North American locations back to Asia Pacific originations, shipping lines offered this capacity to shippers of bulk products at deeply discounted rates, and railways were willing to accommodate any potential traffic growth in this mode. As logisticians looked to arbitrage freight costs container economics became very attractive. When the economic slowdown in 2008 sent bulk ocean rates plummeting, the economics shifted back in favour of bulk movements and the transition slowed. The last three years have seen the total average movement of grain in containers holding between 8 and 12% of Canada's total export movement, as seen in Figure 15 below.

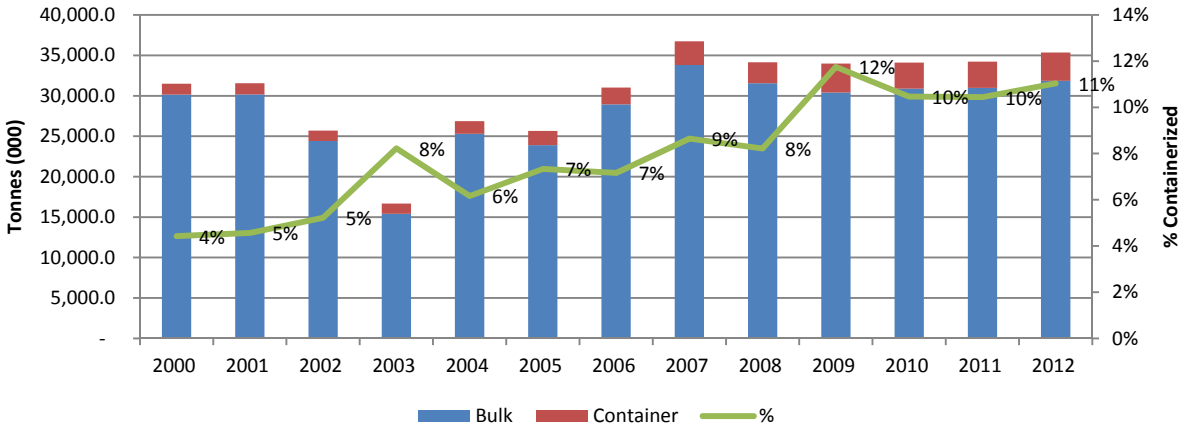


Figure 15 - Percentage of Containerized grain vs. total grain shipments from port, 2000-2012 (source: Ports of Vancouver, Montreal and Stats Canada)

Pulse and special crops make up the majority of containerized exports. The great majority of containerized grain exports move through the ports of Vancouver and Montreal with a much smaller volume handled through the port of Halifax. Containerized grain may be loaded to ocean containers directly at processors at

inland locations or it may be shipped via rail for transloading to ocean containers at the ports (Vancouver and Montreal predominantly).

The process of handling bulk products in containers is accomplished without having to elevate and store large quantities of product such as is employed in primary country and terminal elevators. The "soft handling" of products used in transloading operations results in reduced product degradation for grains that are sensitive to rough handling as is particularly the case for many of the pulse and special crops such as lentils and beans. Container shipping is also amenable to the shipment of shelf ready bagged product, and allows the shipper increased control over product branding and marketing.

There are a number of options for shippers who are exporting grain in containers:

Source loaded containers: Ocean containers are provided to shippers at inland loading points in the Prairie Provinces or in central Canada and products are loaded in bulk, or in bagged form at the shippers' processing facilities. The containers then move over the road to railway inland Intermodal terminals for loading to flat car and movement direct to container port terminals in Montreal, Vancouver and Halifax.

If the shipment is being source loaded at an inland origin location (normally from a processing plant), then the container will be loaded and moved via truck to a railway Intermodal terminal for loading to a flatcar and subsequent movement directly to an ocean terminal where the container will be unloaded from the railcar and staged for loading to vessel.

The origin trucking (drayage) may be arranged by the shipping line or freight forwarder or by the shipper. For source loaded shipments of ocean containers, the shipper of record and the rail freight agreement with the railway are both the responsibility of the shipping line that owns or controls the container and not the grain shipper. The grain shipper's commercial contract is with the shipping line and as a result it is the shipping line that must ensure that all billing information is prepared and provided to the railway in advance, with the support of information provided by the shipper or their freight forwarding partner.

Grain transloaded at port: A shortage of 20 foot containers at inland locations necessitates that shipper's wishing to export grain in a container to look for an alternative to source loading. The most logical option is for grain to move to port by rail and then transload the product to an ocean container. To accomplish this, the shipper needs to coordinate the booking of ocean freight with the ordering of rail cars or domestic intermodal equipment. The transit time on hopper or box car movements is much longer on average than transit time on intermodal movements. For example, a hopper car from a loading location in Saskatchewan may take 4 days on average to move to a transloader in Vancouver but the range of transit times for such moves will be from 3-9 days from the most consistent service locations and will be as wide as 3-12 days for more remote locations with less consistent service.

Shippers will load their bulk product in railway hopper cars or their bagged product in railway box cars, at their processing facilities. These cars are then shipped to locations near the ports of Montreal and Vancouver where transloaders unload the railcars and place the bulk or bagged product into ocean containers for movement via roadway to port ocean terminals.

Another option that is being used with increasing frequency, is to load the grain in either 53 foot domestic containers or in 40 foot ocean containers at inland points and then move these containers to facilities near the ports where the grain is transloaded into 20 foot containers, which are more suitable for loading of high density pulse and special crops for ocean transport. This is commonly referred to as domestic repositioning

(DRP). [41] No shipping lines operating from Canada utilize 53 foot containers for exports of agricultural products. The 53 foot containers used in Canada for transloading are generally domestic backhaul containers that handle consumer goods both nationally, and as a result of the consolidation of import products from ocean container to domestic container at locations near the ports of Montreal, Halifax and Vancouver.

The option of loading containers at port has become more prevalent and favoured by the industry for three primary reasons. First, the supply of twenty foot containers at a port location is far more abundant than found in country locations. Secondly, shipping lines look to optimize their container fleet utilization and do so by ensuring the empty is returned to a port position as soon as possible, allowing them the option of "evacuating" the container empty so that it can return to the origin and obtain another load as quickly as possible. Thirdly, railways in the early growth stages of the export container industry would reposition empty containers to alternate loading locations in the country at no or low charge. As the industry grew, they adopted a cost recovery pricing approach which discouraged all but a few shippers from using the repositioning option.

There are now several permanent grain transloading operations in Canada, nine of which are at port locations (five in Vancouver, three in Montreal and one in Halifax). These operations include land for the storage and staging of ocean containers, front end loading cranes for moving containers to and from truck chassis, rail trackage for receiving and unloading rail cars and moving grain on conveyor systems for elevation and transloading to containers. These facilities may also have warehousing facilities, systems for loading bulk grain to bags, equipment for transloading bagged product from boxcars, domestic containers or trucks to export containers and may provide container storage and maintenance facilities for shipping lines.

Movement of Processed Grain Products

The largest volume of processed grain products moving within the grain logistics system in Canada is composed of canola meal and oil that is produced at crushing and refining facilities in the Prairie Provinces and in Ontario. The canola industry employs a multimodal supply chain that includes road, rail, lake and ocean transportation to ship its products to customers in North America and overseas.

Most of the canola seed delivered to crushing facilities for processing is shipped by truck directly from producers with a small volume of seed arriving at crushing plants from primary elevators by rail. Canola meal, used primarily as a feed ingredient for animals, is shipped primarily by rail from processing facilities, with 66% of total exports moving by direct rail to export markets in the US and approximately 20% moving to Vancouver by rail for loading to ocean vessels at Vancouver port terminal elevators. A small volume of meal exports (1.3%) are shipped through transfer elevators in the Lower St. Lawrence and 13% moves by truck through southern Ontario and western Canadian gateways to the US.

Canola meal shipments by rail move in covered hopper cars that are ordered through the railways regular grain service car supply programs. Shipments moving to export markets from port terminal elevators must be coordinated within the demands of the rail network and the port terminal elevator network as already described for bulk grains. All of the issues that apply to bulk grains also therefore apply to canola meal shipments moving through these ports. Those shipments that move to the US, do not have the complexity in terms of pipeline and terminal management that applies to bulk vessel exports, however, these shippers must

[41] This 40 foot to 20 foot transload system has become popular because there is a surplus of 40 foot ocean containers available in inland areas where they have been rendered empty after being unloaded with imported consumer goods. Railways have begun aggressively marketing the use of surplus 40 foot ocean containers in domestic service since Canadian regulations restricting the use of such containers for domestic service were relaxed in recent years. Shippers benefit from favourable inland rates on 40 foot equipment and can still use transloading to optimize their ocean shipping rates though use of 20 foot equipment, which is available in greater supply in port areas, for their ocean shipments.

complete documentation to satisfy US Department of Agriculture and US Department of Homeland Security requirements in addition to standard domestic bill of lading information.

Approximately 56% of canola exports leave crushing facilities via direct rail to the US predominantly via gateways in Western Canada. Trucking accounts for 3% of exports and a higher proportion of domestic shipments. Exports by water are handled primarily through Vancouver (87%) with the balance split between transfer elevators on the St. Lawrence and a very small volume through Halifax.

Canola oil shipments move in special food quality tank cars that are leased and managed by the shipper (they are not provided by railways). Shippers absorb the risks associated with predicting fleet requirements which are based on expected average railway cycle times between the shippers' origins and destinations. If shippers overestimate the cycles, they risk investing in too much rail equipment and if they underestimate or if railways suffer unusual network performance problems, shippers will be short of equipment to meet their requirements. At port destinations, canola oil is loaded to tankers at a limited number of terminal locations and there is little storage available to unload waiting cars if they do not arrive in a timely way to meet vessel availability.

All of the issues that affect other bulk grain shipments with respect to the predictability of vessel arrivals, port inspection processes and railway performance variability also apply to canola oil exports – with the additional factor that storage at port locations is very limited and cars that must be unloaded must generally be held on railway property awaiting unloading if congestion occurs at the port.

Summary

The distance grain must move from country to export port, the geographic impediments and climatic conditions all lend to the massive challenge faced by the Canadian supply chain in delivering grain to the global markets. They are, by a long stretch, far greater here than for any of the competitor countries. As such, the transportation and logistics of Canadian grain are integral to our supply chain making it essential that it not only be good, it must be the best in the world, lest our reputation as a reliable supplier of grain will suffer.

The forecasting and communication processes within and between the participants in the supply chain must be effective and efficient. The logistics processes should also be linked to the marketing and sales processes in order to gain optimal efficiency. This is a challenge that has confounded the system time and again, and has been experienced as recently as this past crop year.

While the flow of grain – from the initial sale to the final delivery of the product – is the purview of the grain company, the control of the rail capacity (the allocation of railcars) is completely within the control and responsibility of the railways, a change from the time of the single desk control exercised by the Canadian Wheat Board. This has proven to be a challenging role for the railways and caused considerable consternation amongst the users of the rail system. As production volumes continue to grow in the future, railway capacity will continue to be one of the factors in the growth of the grain industry in Canada.

Challenges and Risk Management in the Canadian Grain Supply Chain

The key challenge within a supply chain relates to the tension between the participants in their pursuit to optimize their individual positions which often sub optimizes the overall efficiency of the system. Inefficiencies and risks in supply chain performance have the potential to exacerbate this situation. While some of the risks are within the control of supply chain users and suppliers (for example segregation, port reservation system etc.), other risks (such as weather-related events) are outside of their control. This section includes a discussion of the following risk areas:

- Product quality (integrity of inventory and meeting contracted quality standards; physical loss of product);
- Delivery risk (not on time as per contract, costs of demurrage);
- Environmental risk (snow, rain, etc.);
- Labour unrest

Quantitative analysis undertaken as part of this study for the period 2010 to 2011, together with feedback obtained through stakeholder consultations provides insight into some of the impacts of weaknesses in the grain supply chain. Important findings from the analysis of the system's performance during the two-year period in question include the following:

- The Vancouver logistics pipeline experienced significant stress during the 2010-2011 grain year as compared to the prior year. This was evidenced by a substantial backlog of vessels in port waiting to load grain beginning in October 2010 and lasting until late May 2011.
- The majority of the backlog in demand was attributable to the CWB managed grains.
- Despite the rising backlog of demand experienced during this time period and the increasing delays incurred by vessels in port, vessel loading rates and productivity were very similar to those experienced in the prior year suggesting that terminals could not increase the speed at which they loaded vessels in response to the increased vessel delays.

Based on feedback from industry stakeholders, the factors that are believed to have contributed to this delay in vessel loading at Vancouver were:

- A diversion of approximately 250,000 tonnes of CWB grain traffic from Prince Rupert to Vancouver in the early weeks of the grain year.
- Somewhat higher than normal delays in loading vessels due to more frequent heavy rainfall events in Vancouver, particularly between January and March of 2011.
- Severe weather events in the railway mountain corridors of British Columbia, particularly on CP.
- All grain companies commented on the quality of communication from the railways, particularly CP, with an emphasis on the lack of information on the ability and timing of recovery from their operating challenges and disruptions.

A more detailed examination of these findings follows, aligned with the associated supply chain risk. The detail of the quantitative analysis and the stakeholder consultations can be found in the Quantitative Analysis technical document associated with this report.

Risks and Challenges

The Canadian grain supply chain faces challenges unlike any of its competitor countries and must manage the risks associated with those challenges in a way that ensures the supply chain operate in the most efficient manner possible. Those challenges include environmental, geographic, resource and labour in addition to those that stem from the commodity price fluctuations of the global marketplace, amongst others. The following discusses many of the major challenges, their associated risks and some of the ways that stakeholder deal with them.

Product Quality

Product quality is influenced by a number of factors, including seed variety, agronomic practices, and environmental conditions. These factors are discussed in greater detail in the Marketing and Logistics technical document associated with this report. It can also be influenced by factors associated with crop logistics, such as product warehousing, segregation and transportation, which are the focus of this section.

Warehousing Practices

In terms of risks related to product storage, the first step in managing risk is the employment of sound warehousing practices. Some products such as canola can spontaneously heat while in storage. When the condition of inventory is conducive to such problems, operations management may need to "turn bins" more frequently, or warehouse products differently, slowing down operations and potentially negatively impacting broader supply chain activities.

Segregation

The second key factor in terms of product quality is associated with segregation strategies. In recent years, marketing efforts, increased sensitivity to food security and health issues as well as buyer demand have increased the need for additional segregations of grain. These changes include:

- An increasing diversification of crops produced for export and handled through the system
- An increase in the level of precision with respect to the terms of sale for CWB grains, particularly with regard to the differentiation of protein, gluten and falling number for wheat movements (e.g., product characteristics)
- Increasing flexibility in blending to achieve specific characteristics required by buyers
- Increasing instances of market restrictions and requirements for testing for sanitary and phytosanitary issues (including unapproved genetically modified traits), as has recently been experienced with flax shipments to Europe.[42]

These trends towards increasing segregations of grain can act to increase the complexity – and in the absence of effective coordination of logistics – reduce the throughput capacity of the system leading to increasing instances of congestion and a requirement for additional port terminal capacity to maintain supply chain fluidity.

The segregation of grain to allow for future blending requires that individual bin capacity in an elevator be available for each lot that is to be segregated. Where a high degree of segregation is required, it may result

[42] The Triffid case study is an example of how market based issues can directly impact supply chain operations. Because of this case the CGC has now instituted sampling and testing protocols not only for EU destined flax but also shipments to Japan and Brazil.

in a lower average utilization of bin space in an elevator – thus creating a potential for congestion in highly utilized facilities.

Congestion in port terminal operations resulting from a high level of segregated stocks for an extended period of time will impact terminal capacity which may in turn reduce the ability of the terminal to unload railcars in a timely manner. Reduced productivity in railcar unloading at port will directly impact the available capacity for loading of grain in the country as it will result in fewer cars being available to meet customer orders, potentially resulting in congested country elevators and limited opportunities for producers to deliver the grain from their farms. Furthermore it can result in congestion in the rail network as grain traffic cannot be delivered to terminals for unloading at the rate required to maintain system fluidity, as well as extending the loading time for vessels and the subsequent backing up of vessels in port.

This coordination between grain handling stakeholders is complicated by the need for segregation of grains within an elevator to match sales requirements. As the need for segregation increases, the risk of lowering the effective storage capacity of an elevator becomes greater as well, whether at the port or in the primary system. When grain from various users of the system cannot be comingled, it may be difficult for elevators to obtain maximum utilization of storage bins. This can lead to an elevator becoming short of the capacity required to receive additional grain to support planned vessel loading and by extension, congestion in the port.

In the country elevator system, average elevator utilization levels are much lower than they are at the highly utilized port terminal elevators – particularly on the West Coast. Thus, the choice of where supply chain stakeholders hold highly segregated stocks in order to preserve blending flexibility is of critical importance to the performance of the grain supply chain. In general, if segregations beyond those required for an immediate sale are held in the most highly utilized facilities – it creates the potential for sub-optimization of the supply chain.

In early consultations with stakeholders there was a general consensus that fewer segregations of wheat may be held in port positions as a result of the elimination of the CWB single desk. However, there has been an acknowledgment that the combined forces of changing logistics patterns and market evolution will have uncertain effects on the actual segregations of various crops and how they are sold. Stakeholders suggest that over time price signals to grain merchants and producers may become clearer as pricing based on quality attributes other than grade and protein becomes more prevalent.

Some markets, such as the U.S., Mexico and Japan, are expected to continue to seek high quality (protein) wheat from Canada. Others will likely focus on specific milling requirements or characteristics such as falling number, moisture, kilogram/hectoliter weight and foreign material while still others will be primarily concerned with price. Marketers are expected to work with end-use customers to find markets for different varieties and provide farmers with the price signals necessary to encourage production. These future marketing opportunities may also present challenges to the supply chain if they require greater identity preservation or segregation throughout the system. To the extent possible, grain companies will seek to achieve efficiencies in the country elevator system before the products are moved to port.

Specialization of grains at terminals has proven effective at increasing efficiency over the last number of years. In Vancouver, certain elevators concentrated their business on a limited number of grains to simplify handling and increase efficiency. This was possible as terminals worked with the CWB in directing CWB grains to other terminals. The long-term impact of the open market on specialization remains to be seen, but the experience seen in the 2012-13 crop year indicates that some elevators that had previously specialized in non-CWB grains are now handling a wider variety of grains. The effect of this change on efficiency is unknown at this time though there are indications that stakeholders' terminals are working to compensate by staging grain and segregating through time.

Physical Loss of Product

Insurance provides a mitigating vehicle for dealing with the risk of outright physical product loss. Additionally, in a number of circumstances, shipping tolerances and contractually agreed upon "shrink" allowances are used in recognition of the fact that product can "disappear" through no one's fault—e.g. normal course spillage.

Verification of product weights through inspection also provides a mechanism for dealing with potential product loss issues. Weighing services are provided by independent third parties including the Canadian Grain Commission or private sector companies. Certification of product weights is done both at inland transshipment points (e.g. elevators) and port facilities. Depending on the nature of the commercial relationship buyer and seller may simply agree to weigh grain in-transit (e.g. track scale).

Delivery Risk

Delivery risks exist at multiple points across the supply chain. These risks are compounded by volume peaks in the Canadian grain harvest. While grain traffic flows through the logistics system throughout the year, there are typically two peak shipping periods for Canadian grain: September to December and February to April.[43] Grain price premiums are often the highest in the immediate post-harvest months due to international cycles of production of grain. Terms of sale dictate that much of the crop may be sold up to 90 days in advance, or more. In addition, farmers and grain companies can decide to limit carryover of stocks from the previous crop year and provide room for on-farm storage in preparation for Canada's annual harvest, or attempt to maximize sales during this peak period due to cash flow considerations in preparation for seeding and production of new crop. This creates high demand for transportation in the September to April period.

These peaks put pressure on various components of the logistics system including; country elevator networks, railways and port terminals. This can make the system more fragile during peak periods in the event of a disruption somewhere in the logistics system and may require a greater overall investment in infrastructure to handle peaks versus a lower average level of shipping that might exist if the drivers of such peaks could be addressed.

Railway Operations

In discussions with stakeholders including railways and grain companies, both groups commented on the challenges encountered by the railways in meeting demand for empty car supply and in movement of loaded traffic. It is important to point out that problems with rail customer service were not experienced symmetrically across the railways. In general, shippers pointed out that the problems were more severe on CP than on CN (the circumstances are discussed later in this segment). One major shipper provided Quorum with copies of railway grain service reports for their traffic over the two year period. This data showed that CN, though challenged during 2010-11 to meet shipper demands, was able to provide approximately 70% - 80% of the cars that were allocated to the shipper on their grain service plans – in the week for which they were allocated.[44] This performance was achieved during the most difficult winter months, and their performance in the fall and spring periods was between 80% and 100%. CP, however, struggled to deliver over 40% of the cars that they had allocated on their own grain service plans to this customer during the winter months. Numerous customers indicated that they were in constant contact with CP during this period and the message being given by CP to its customers at this time was that they expected to recover from the accumulated

[43] At their highest point, average monthly unloads in Vancouver can exceed 13,000 cars as compared to an average of 10,600 cars per month in non-peak periods.(Comparison to Grain Monitoring Program data)

[44] The data supplied by the shipper was supplied on a confidential basis and was verified as correct through a comparison with Grain Monitoring Data.

shortfall, and that resources were being put in place to return service to more normal levels, although they would not commit to a specific period of time.

Over the longer term, the railway system has generally been able to accommodate total volumes offered for carriage; however it is characterized as a source of uncertainty rather than constraint as it is sometimes hard to predict the ability of the rail system to respond to demand changes over seasonal planning periods and recover from the impacts of weather related service interruptions.

Country Elevator System

The elevators are broken into two groups in the quantitative analysis. One group of elevators was focused primarily on the movement of non-CWB grains during this period and the other elevators handled a mix of CWB grains and non-CWB grains. The average levels of capacity utilization are higher at the group that handled both CWB and non-CWB grains. This is to be expected due to the need to hold additional segregations of wheat, barley and durum to be available for blending to meet customer specific sales requirements as opposed to non-CWB grains which require many fewer segregations and less blending to meet requirements, as described earlier in this report. However, while average working capacity utilization was higher at the elevators handling non-CWB grains, we do not see a significantly higher average utilization of these elevators in 2010-11 as compared to the previous year suggesting that while congestion may have occurred from time to time at the elevators – with spikes in working capacity utilization, there was generally available capacity to support throughput if the grain required for loading was delivered by rail to the elevators.[45]

Port Terminal System and Transloading Facilities

Port terminal throughput can be affected by the match between the grains held in store and the grains required for loading. The ratio of storage to throughput at West Coast terminal elevators is very low, requiring elevator users to match inbound rail volumes and grades to planned vessel arrivals. In terms of Port transloading facilities, there is limited storage capacity for containerized grain products at port transload locations and many products are sensitive to the rough handling of most bulk storage systems.

Call periods are a matter of negotiation. In some circumstances, exporters have sold grain for very wide call periods—e.g. “full May” i.e. the entire month of May. This has the potential to create congestion in the port as grain has to be available any time during May, at the call of the purchaser. This results in stock either being pre-positioned in the terminal for what can be an extended period, to await vessel arrival, or risk is created that vessel demurrage will be incurred if a vessel arrives and not all stock is available to satisfy the contract. Shorter call periods (10 – 14 days) are preferred as they encourage “just in time” movement. However, the counterbalancing risk is vessel demurrage if the grain is not positioned in the port terminal in time.

Stakeholders indicated that congestion at the heavily utilized Port of Vancouver was a major source of sub-optimal performance of the grain logistics system. The quantitative analysis was conducted in order to obtain greater insight into the underlying causes of congestion and to study the way the system responded to periods of congestion. Data provided by the Canadian Ports Clearance Association and the Canadian Grain Commission was used to identify the number of vessels that were available for loading at the port of Vancouver on a daily basis.[46] In addition, total demand for grain represented by the vessels waiting loading,

[45] More detailed analysis or working capacity utilization of the CWB/non-CWB group of elevators confirmed this conclusion that this element was not an important barrier to throughput in the second year of the study. For the group of elevators handling both CWB and non-CWB grains, working capacity utilization was over 85% at any individual elevator in this group 14.1% of the time in the first year and 14.4% in the second year – a statistically irrelevant increase.

[46] Vessels were determined to be available for loading after they had passed safety and phytosanitary inspection by Transport Canada and the Canadian Food Inspection Agency at the Port of Vancouver.

or partially loaded at the port was also analyzed.[47] This review identified periods of congestion that could then be studied in more detail. The total number of grain vessels in port that had passed inspection and that were awaiting completion of loading and the cumulative number of vessel delay days represented by those vessels.[48] The average weekly vessel count and the total days vessels were delayed climbed quite steadily from the fall of 2010 and did not decline until the spring of 2011.

In 2009-10 there were approximately 450 vessel calls at the five major Vancouver terminal elevators and each vessel berthed at 2 different terminals on average to complete loading. This resulted in 3.5 berthings per week on average at each of the grain terminals. Given the intensity of the use of the terminals – it is easy to see how quickly a port terminal can become congested with grain rail shipments from primary elevators if rail shipments are not scheduled to match vessel scheduling or if vessels or rail cars do not arrive as planned by grain operating companies and their vessel chartering partners.

When vessels are delayed, rejected due to inspections by Port Wardens[49] or CFIA inspectors,[50] or arrive out of the planned loading sequence, they must wait at anchorage in the port, potentially incurring significant cost to the grain companies for vessel demurrage. Export grain moving through the west coast, Churchill, Thunder Bay and the Seaway incurred demurrage charges to grain shippers of $50 million in 2010-11.[51] This was due to a large increase in average waiting time in port in that crop year compared to previous years. The average annual net demurrage cost for the previous 10 year period was $8.8 million.

Once cleared, vessels will move to a berth to initiate loading and may move to multiple berthings at multiple terminals to complete loading. At Vancouver, over the last five years, an average of 41.5% of vessels loaded at a single berth and of the remaining vessels they averaged 2.3 berthings per vessel. 15% of vessels needed 3 or more berthings to complete loading.[52]

Until the change in the mandate of the CWB on August 1, 2012, the ordering of rail cars and the planning of wheat and barley movements via rail to port terminals from primary terminals and the booking, coordination and scheduling of ocean freight vessels was the responsibility of the CWB – in coordination with the railways who determine rail car allocation and rail scheduling based upon customer car orders and their commercial requirements. The owners of the grain terminals coordinate movements of grains not marketed by the CWB, through their own terminals and are responsible for booking their own rail and ocean freight. Ocean freight may be booked directly by the marketing agent or through ocean freight brokers. In addition, non-terminal owning grain marketing companies will contract for the use of port terminal elevators for their grain sales through the same system. This requires careful coordination of grain movements by rail and vessel between the various users of the port elevator system to ensure that conflicts do not arise in the requirement for rail car unloading, storage, blending, cleaning or ship loading capacity.

Very large or very small sales can affect supply chain efficiency. A very large sale involving a large vessel may require consolidating inventory at port position, lowering total available storage space. It also may

[47] The "demand" for grain as represented by a vessel arriving at the port was determined by looking at the grain that the vessel ultimately loaded at Vancouver terminal elevators. In calculating the demand for grain loading on a given day, the total volume by grain and grade of all grains that were loaded by the vessels waiting at the port was ascribed to the first day that a vessel arrived at the port. That daily demand was then applied to each subsequent day until the grain was actually loaded to the vessel. For vessels that were partially loaded on a given day, the grain that was actually loaded to the vessel was removed from the outstanding demand on the day it was loaded.
[48] Vessel delay days are calculated by adding up the multiple of each vessel's total days spent waiting in port, for a given day. So if 10 vessels are in port and all vessels have been in port for 10 days, the total vessel delay days would be 100.
[49] Port Wardens are generally marine surveyors of the Canadian Coast Guard Ship Safety Branch appointed to carry out functions, such as steamship inspection, Pollution Prevention Officer, and other safety related functions. The Port Warden verifies the structural and operational integrity of a vessel upon presentation at a port. When satisfied that all conditions have been met the port Warden will issue a certificate of readiness to load.
[50] A CFIA inspector will inspect the hold and ships loading area to ensure it complies with Canadian phytosanitary regulations.
[51] Monitoring the Canadian Grain Handling and Transportation System. Annual Report 2010-2011 crop year. Quorum Corporation
[52] Quorum Corporation.

require a seller to enter into a grain purchase or "trading of position[53]" with another seller in order to assure an adequate grain supply to load a vessel within and efficient period of time. In the case of smaller vessels or small lot sizes, the product moving through the bulk handling system may require special binning, lowering effective terminal working space. Likewise, products that have special characteristics (e.g. malt barley) may need to be handled in a particular way. Movement via container for smaller volumes or special crops can be a cost effective alternative to the bulk system.

Another factor that contributed to the ship loading delays at Vancouver in 2010-2011 was a drop off of shipments to Prince Rupert, BC; which diverted some traffic to Vancouver. This was seen as creating extra demand at Vancouver and contributing to the backlog of vessels at that port. There is a notable drop in the volume of CWB grains delivered to the port in the first 12 weeks of crop year 2010-11. According to system stakeholders, this diversion of grain away from the port was due to a dispute between the CWB and Prince Rupert Grain over the terms of their operating agreement at the port. The volume of CWB grains that appear to have been diverted from the port is approximately equal to the surplus demand experienced at Vancouver (approximately 250,000 tonnes).

If the rail system had been able to keep up the average level of volume in the second half of 2010-11 that it was able to deliver in 2009-10, the backlog of vessel loading at Vancouver would have been much less severe, if significant at all.[54] So, while the diversion of CWB grains from Prince Rupert contributed to the creation of excess loading demand at Vancouver, it was the failure of the system to respond to this increased demand that ultimately caused the more significant congestion at the port that occurred in the second half of the crop year.

Ocean Vessel Charter Performance

The activities surrounding the arrival, loading and departure of ocean vessels at port is an integral part of the Canadian grain supply chain. As noted above, the scheduling and actual loading of grain to ocean vessels impacts activities right back to the country elevator and farm gate. There are several issues and challenges that have an effect on the timely loading of vessels that are discussed in this section.

Vessel Arrival at Port

The performance of empty vessels arriving at port and the occasional diversion from scheduled times that some vessel charters incur causes concerns with grain shippers. Overall port and terminal performance can and is directly impacted as the data for the arrival of empty ocean vessels at the loading port is difficult to acquire and the actual causes of delay or diversion from the original vessel charter plan can be challenging to confirm. As such, we must rely on input from stakeholders to provide the input and information on performance variability of these movements. As described by stakeholder, the causes can range from mechanical problems with the vessel to the buyer switching vessel charters either through an attempt to arbitrage freight rates or because they redirected a vessel to a higher priority movement. As this analysis does not examine the consistency and reliability of empty inbound movements, the actual impact of those diversions cannot be quantified or validated, however, anecdotal evidence as provided by some of the port terminal operators indicates that the lack of consistency in empty vessel arrivals can challenge the planning cycles of terminals. This can result in extended storage times of some grain as it waits for the proper vessel

[53] Trading of position refers to a practice where one grain company or exporter will arrange to secure product from another seller who has that product readily available and in their local inventory, with a commitment that they will replace the identical product at no marginal cost within a specific timeframe in the future.

[54] In 2010-11, the average weekly delivery of grain via rail to Vancouver in the last 30 weeks of the crop year was 289,000 tonnes or approximately 3140 railcars. In 2011-12, the average was only 265,000 tonnes or 2880 rail cars. If the 2009-10 level had been maintained in the last half of 2010-11, sufficient grain would have been delivered to reduce the approximately 250,000 tonne backlog in 10.5 weeks.

to arrive at port. The impact on the supply chain can include delays in railcar unloading (as terminal storage space becomes limited, thereby impacting the loading of other vessels in port as product is held back), putting vessel loading out of planned order and ultimately causing product to back up into the country.

Extended loading times and vessel backlog

The data show that overall during the period under study, the time taken for a vessel to clear the port increases with the number of vessels in port. This data (see Figure 16) suggests that the port terminals were not able to keep up with the increasing number of vessels waiting to load. As the number of vessels waiting increased, average loading time grew. When only 10 vessels were in port it took an average of approximately 8 days for the vessel to complete loading however, when there were 25 vessels in port it took an average of approximately 13 days to complete loading – an increase in time in port of 63%. To determine the potential causes of delay, particularly during the period from October 2010 to May 2011 further review and analysis was undertaken. The first step was to examine the weekly port terminal loading performance.

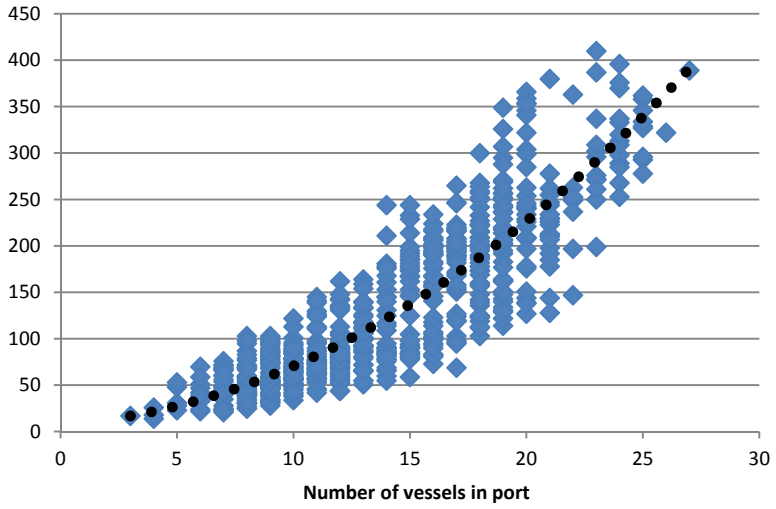


Figure 16 - Cumulative vessel delay days vs. number of grain vessels in port (scatter plot)

It shows that while loading volumes vary widely on a week to week basis, the trend in overall weekly volume across the two years was flat, suggesting that through this period the port saw neither improvements nor degradation in the actual loading of vessels.

Detailed data on ship loading activity was provided for two of the five terminals in Vancouver. One of the terminals was almost exclusively involved in handling non-CWB grains and the other handled mostly CWB grains. The data provided a detailed view of port terminal berth utilization during the study period for these sample terminals. The total time spent loading vessels were virtually unchanged from one year to the next, and showed no material increase in average loading rates between the two crop years. In the second year, consistent with the greater backlog of vessels at Vancouver, the level of berth utilization (the percent of total available time that vessels spent at berth) was higher. However, in spite of the backlog of vessels, this did not translate to a greater time spent in loading and only increased the delay and idle time of vessels at berth.

In discussion with stakeholders about the possible reasons for the backlog of vessels at Vancouver in 2010-11, they suggested that Vancouver experienced heavier rains than normal during this crop year[55] and that rain delays during loading might have contributed to a lower level of productivity than was necessary to satisfy demand for loading.

[55] A review of Environment Canada weather data for Vancouver showed that rainfall was 9% higher at Vancouver in the second crop year as compared to the first and there were an additional 17 days with rainfall in excess of 5 millimetres in 2010-11 versus 2009-10. Rain delays in Vancouver are normally heaviest in November and December but there were significant rainfall events through March in crop year 2010-11 as well.

A further review of the ship loading data showed that reported rain/snow delays for vessels at the two sample elevators in the 2010-11 crop year were higher than the previous year. [56] The analysis shows that if rain and snow delays were at the same level as in 2009-10, it would have increased the time spent in loading by 1.2% - which would have potentially allowed for a 3.4%[57] increase in loading of vessels, given the higher berth occupancy in 2010-11 versus 2009-10. The great majority of the extra time that vessels spent at berth in the second year was composed of idle time which was not attributed to any specific cause such as weather, mechanical issues or labour issues.

The challenge faced by industry during the period in question was the backlog of demand, as reflected in the increasing amount of grain vessels waiting at the port through that period. The majority of increased demand, or backlogged loading at Vancouver, was for CWB grains. This backlog began to increase in October 2010 and was not cleared until the spring – mirroring the vessel delays in port as shown in Figure 17. The average backlog or queue of vessels in the peak months between October and March of the first crop year amounted to 409,000 tonnes of grain representing loading demand of 10.5 vessels. In the second year, during this same peak period, the average queue of vessels represented demand for 628,000 tonnes of grain or 16 average sized vessels. If the increase in productivity due to lower rain delays was spread over the October to March period (the months when rain delays are generally incurred) it would have allowed the terminals to eliminate the backlog of vessels waiting to load in approximately 13 weeks and would have prevented the extensive congestion in March and April of that year.[58]

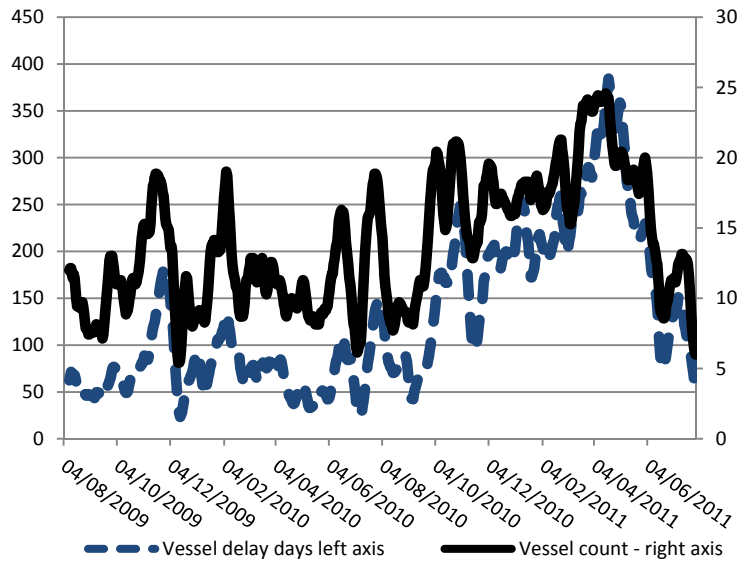


Figure 17 - Vessel Delays at port of Vancouver (7 day moving average)

The throughput to remove the backlog could only be accomplished if there were sufficient deliveries of grain to the Port terminal elevators to support this increased vessel loading.

Railcar Unloading

Data on the total volume in tonnes of grain unloaded from railcars at Vancouver port terminals by week for the two crop years showed that the unload pattern for non-CWB grains was similar across the two crop years with volume peaks in receipts shown post-harvest and then again in the spring. For CWB grains however, a strong peak in receipts was not experienced post-harvest and the spring peak much lower in 2011 than in the previous year.

[56] In Crop Year 2009-10, rain and snow related delays represented 69% of the total delayed loading time, increasing to 74% in 2010-11.

[57] The increase is calculated by taking the proportion increase in the total time spent in loading and dividing by the total proportion of time that is spent in loading: 1.2 ÷ 35 = 3.4%)

[58] Based on an average daily vessel loading of 48,000 tonnes per day over the period, if the 3.4% annual increase in ship loading was concentrated over 6 rainy months it would increase daily throughput by an average of 6.8% per day – or 3264 tonnes per day. Thus the backlog of 219,000 tonnes would be cleared in 67 days or 13 weeks.

The arrival of ships at Vancouver for loading of CWB grains and the subsequent delays to loading of these vessels that is seen in the earlier data suggest that the CWB had the expectation to ship higher volumes of grain through the Port of Vancouver than was achieved through most of crop year 2010-2011. A review of the make-up of the pent up demand at Vancouver for CWB grains and the performance of the rail logistics system provides further insight into the causes of this congestion.

It was suggested by some stakeholders that the type of grain or degree of segregations required for those grains could be a potential cause for the decrease in unloads. The data shows that wheat made up the majority of CWB grain throughput at Vancouver. When looked at by grade of wheat it is clear that high quality #1 CWRS made up much more of the crop in the first year than in the second, due to a generally lower quality harvest. However, it also appears that during the second year, the overall demand – and the pent up demand for shipping at the Port of Vancouver, was not dominated by a particular grade of wheat.

Right Grain, Right Place, Right Time

A concept that has become one of greater focus in the industry today is that of ensuring the right grain is at the right terminal at the time it is needed for loading, in other words – the right grain at the right place at the right time. In order to determine if specific wheat grade or protein content was in short supply at Vancouver – thereby contributing to the backlog – a vessel by vessel review was conducted for all CWB grain shipments from the port of Vancouver in November 2010 and February 2011. For this review, each vessel was examined to see if the required grain for the vessel was available in inventory in port grain terminals or in the rail pipeline en route from primary elevators on the Prairies. The results of this review showed that while there was an overall shortage of most types of wheat – there was no pattern to the shortage of grains by grade or protein level during the period of congestion.

Another possible reason for the backlog at Vancouver may have been that the wrong types of grain were being held in store due to pre-positioning of grain at the port by the CWB, and that this resulted in reduced elevator flexibility and throughput due to overly high levels of capacity utilization.

Ocean Transit Times

Ocean transit time was also analyzed. In measuring transit variability by destination country corridor it is important that the number of trips (observations) in the corridor be large enough to be representative. Using a minimum threshold of 30 trips[59], 4 of the 34 countries assessed provided an adequate sample. After reviewing these four samples, it was found that the average transit ranged from 15.3 to 37.2 days and reliability as measured by the coefficient of variation (CV) ranged from 0.12 in the UAE corridor to 0.47 in the Mexican corridor. By comparison, the average CV for rail traffic moving to Vancouver from the Prairies is slightly higher than 0.30. Overall, it was the opinion of the study group that the consistency and reliability of ocean transit from Vancouver origins was well within an acceptable range of performance.

A review of the seasonal variability of ocean transit times using the z score[60] of each trip was undertaken for the two year study period. While some seasonal variation was expected (i.e. longer transit during the winter months) the analysis showed few major fluctuations from the mean, and therefore very little seasonal variability in the transit times of vessels.

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[59] Thirty observations is generally accepted as the minimum number of observations required for the calculation of variability within a sample.

[60] The "z score" statistic measures the performance of an individual vessel relative to the average performance for all other vessels in a sample. The performance score is expressed in terms of the number of standard deviations that an individual vessels' transit time was from the mean transit time.

The analysis provides insight into the loaded transit time performance of ocean vessels that transported grain from Vancouver to various destination countries during the study period. Based on the transit variability analysis conducted on the four largest corridors we conclude that average transit was consistent and reliable in these major corridors. Each of these corridors experienced lower variability, as measured by coefficient of variation, than did rail traffic in the Vancouver corridor during the 2010-11 grain year. This finding corresponds with the insight provided by shippers in both the workshops as well as follow-up discussion where they had indicated that buyers of Canadian grain are generally satisfied with the loaded ocean vessel transit times on grain movements from Canada.

While buyers do not complain about the variability of loaded ocean transit time, they do comment frequently on the challenges of coordinating grain products to Canadian port position to meet vessel loading requirements. This likely is related to the type of vessel charter used – whether the buyer is controlling and paying for ocean freight. As more buyers look to control the ocean freight they become more sensitive to events that cause vessel demurrage. Most often the late arrival of grain/rail cars is seen as the cause of these delays and as such Canada's reputation as a reliable supplier can be damaged.

The St. Lawrence Seaway

A complicating factor for movements via the St. Lawrence Seaway is its somewhat limited season. The Seaway generally opens in March and closes in December of each year due to ice conditions. Despite this impediment, it remains a major gateway for Canadian grain exports as it offers much shorter combined vessel movements to major markets in Europe, Africa and the Middle East as well as access to large North American markets within the Great Lakes basin. One relative advantage of the Seaway is the access to high volume available storage capacity though the Thunder Bay and Lower Seaway terminal elevators. The Thunder Bay elevators alone have 23% more storage capacity than the total available in Vancouver while handling 35% to 50% of the throughput that has moved through Vancouver in recent years. This larger available working capacity of these elevators means that vessels are less likely to face delays in loading due to problems coordinating grain shipments between country elevators and the port.

During the months when the Seaway is closed due to ice conditions, transfer elevators at Trois Rivieres, Quebec City and Montreal, which can load ocean going vessels, have in the past accepted significant volumes of western grain shipments, the majority of which is wheat and durum. While some traffic moves throughout the year by direct rail through these elevators, the majority of volume moves between November and April.

The Seaway traffic has changed considerably since its peak in the mid-1960s when more than 300 lake vessels moved over 53 million tonnes of cargo annually. There are presently fewer than 130 vessels and in 2011 tonnages had decreased to 36.5 million tonnes, of which 9.2 million was grain, less than half of what it was at its peak.

While the reasons for the reduction are many, two are most significant: a change in the markets where Canadian grain is sold resulting in the flow of grain products shifting to west coast ports and; the shift in the marine industry to larger, wider, more efficient vessels for the movement of bulk products that are too large to traverse the Seaway.

As the Canadian laker fleet has aged, its size and capacity has steadily diminished. In 2010 there were approximately 77 vessels carrying bulk products through the Seaway and in the past 4 years 13, or 17% have been scrapped. Many of those vessel scrapped were used in the movement of grain. There are presently 15 vessels planned or in the midst of construction that will begin to replace and enhance the lake fleets capacity. The first of these vessels entered service at the end of the 2013 shipping season.

The reduction in the lake fleet has reduced the available capacity for movement such that it has become the controlling factor on the volume of Seaway traffic. There have been very few new vessels to enter the fleet, in part due to a federal tariff on the purchase of foreign vessels.[61] That 25% tariff was removed in 2011, resulting in orders for seven new lake vessels, two of which were commissioned by the CWB in an arrangement with Algoma Central. While the fresh water of the Seaway's lakes and rivers means the lake fleet enjoys a much longer life than its salt water counterparts, the average age of these vessels is pushing the upper limits of 30 years. It is believed that the coming years will see a resurgence of new commissions as companies look to replace this rapidly aging fleet.

Grain Supply Chain in the New Market Environment

Grain companies indicated that they will have an expanded focus on pipeline management and fluidity in the open market. The advantage they foresee going forward is the ability to control the use of their elevators allowing for integrated movement of commodities. This builds upon their previous operations and programming for canola and other non-CWB commodities. The railways encourage maximum utilization of unit trains through their incentive rate programs. Matching shipments directly to vessel programs through the use of unit trains will achieve the most effective use of all assets and maximize terminal elevator throughput. Country elevator managers will have a mandate to turn over inventory and generate elevation revenue. Management of terminal elevators, especially on the west coast, will also focus on throughput. Storage and blending of grain at port is expected to decrease. The focus on the pipeline and throughput management of facilities is expected to extend the capacity of the current GHTS infrastructure.

At the outset of the new marketing environment some stakeholders expressed concern that companies without ownership stakes in terminal elevators would have difficulty establishing effective commercial relationships to access terminal capacity and therefore serve export markets. Further apprehension was expressed regarding the impact of the loss of information on vessel programs and rail system capacity that was previously available from the Canadian Ports Clearance Association (CPCA) and the CWB. It has been suggested that asymmetry of information puts added pressure on smaller players within the system. Some stakeholders expected that the typical vessel size for loading export grain would decrease with an accompanying loss of efficiency and increase in shipping costs.[62] There is an acknowledgement that cooperation among terminals will be important to reduce switching requirements and avoid sub-optimizing overall port operations at times.

Many stakeholders expected that the traditional peaking in demand during the post-harvest October to December period would be magnified in the first year of the open market with accompanying operational problems. There is a general belief that the CWB managed its sales program in order to reduce demand peaks. In the open market environment, some suggest that the competition for sales programs may lead to an overselling of capacity, especially at Vancouver. While a large export program did materialize in the first half of the 2012-13 crop year operational problems appear to have been minimal, although reports of large numbers of vessels awaiting grain at Vancouver grew throughout the period.[63] Some stakeholders also suggest that competitive pressures will result in the carry-out stocks of wheat being reduced over time, from an average of five to six million tonnes to something closer to two or three million tonnes.

Railways have indicated their intention to continue planning grain movement using their "order book" processes. Railcar allocation will be based on seasonal guidance and matched to terminal capacity. Regular

[61] The few Canadian shipyards left with capability of building new vessels were priced such that vessels could not be built by the domestic industry in an economically feasible manner.
[62] Initial analysis of the size of vessels sailing from the west coast indicates that while the first half of the 2012-13 crop year saw a decline of 10.8% in Prince Rupert cargoes, the size of those shipped from the Port of Vancouver actually increased by 2.6%.
[63] With the closure of the Canadian Ports Clearance Association and loss of its daily vessel line-up report in August 2012, the ability to monitor waiting vessels at Vancouver has been severely compromised.

input/feedback from terminals regarding vessels is anticipated to ensure programs match port needs with the onus on terminal management to control the inbound pipeline. Access to US port facilities by rail has long been available to Canadian shippers, although the economic viability of those logistics has been a challenge. Early in the 2012-2013 crop year, CP announced a negotiated divisional rate with Union Pacific that will allow for the movement of Canadian grain to Pacific Northwest port destinations that has been well received by some grain shippers as being economically viable. Whether U.S. port destinations become a regular outlet for Canadian grain or a "release valve" during periods of peak shipping and/or congestion remains to be seen.

Most stakeholders contend that insufficient capacity exists in the commercial system for it to be used for storage. It has been designed as a just-in-time handling system with ample storage on farms to handle the crop in most years.[64] The exception may be during periods when there is a "carry market", at which time capacity at Thunder Bay and/or in the St. Lawrence Seaway may be used for storage.[65]

CWB Network Access

By the beginning of the 2012-13 crop year, the new CWB had signed handling agreements providing full coverage of facilities across the prairies for producer deliveries of CWB grain. The handling agreements are confidential bilateral contracts and include performance terms. CWB's current role in logistics management is greatly reduced from the monopoly era. For the most part, logistics are managed by grain companies with CWB treated as an "associated party" by the railway. Although there was talk of isolated incidents when elevator managers were reluctant to take delivery of CWB grain without a clear plan for outward shipping, no official complaints or evidence is available to corroborate such claims.

Shortlines and Producer Cars

Many parties anticipated that producer car shipments, and by extension the use of some shortline railways that are heavily dependent on them, would decline dramatically in the open market environment. Experience to date would indicate that producer loading interests and shortline railways have been successful at forging the marketing alliances necessary to maintain their business models in post-monopoly operations. The new CWB continues to be a marketing outlet for producer cars, and in fact can assume an added role as an outlet for canola producer cars now that it is making export sales of canola. But, without the large scale of the monopoly era, CWB will be challenged to absorb off-grades into its export program, thereby necessitating the transfer of risk of off-grades to the producer shippers.

In the first quarter of the 2012-13 crop year a comparable number of producer cars were programmed to that of the previous crop year. At the first half mark, the numbers slipped somewhat from the record 5,946 car level programmed in 2011-12, but still register respectably at 4,726 cars, when compared with the past five year average of 5,437 cars.

Whether shipping producer cars or dealer cars (ordered directly from Class 1 railways), shortlines acknowledge that the key to their success will be developing relationships with a number of partners and then demonstrating reliable performance. CN and CP indicated that their position on producer cars remains unchanged. As long as they have a designated unload destination, they will be included along with the rest of the grain shipping program.

[64] On farm storage in western Canada is estimated to be sufficient to handle in excess of 50 million tonnes. Farmers may see opportunities in increasing storage to provide added marketing flexibility and take advantage of carry market situations themselves. These decisions must be weighed off against the additional cost of building storage, the ongoing operating costs (aeration, etc.) and property taxes as well as the risk that stored grain can go out of condition. Canadian farmers already have much more on-farm storage than their U.S. counterparts.

[65] A "carry market" is when the difference in price between futures delivery months is sufficient to cover all associated costs (i.e. interest, insurance and storage) of holding the product.

Port of Thunder Bay

The removal of the single desk resulted in the elimination of the Freight Adjustment Factor (FAF), a deduction to reflect added costs associated with shipping through the St. Lawrence Seaway that was applied to CWB deliveries in the Thunder Bay catchment area. Some stakeholders suggest that the FAF did not fully reflect Seaway costs and that a move to commercial freight calculations following the removal of the FAF would result in the Thunder Bay catchment area shrinking and west coast catchment expanding.

The evidence for the 2012-13 crop year thus far contradicts this theory. To the close of navigation, Thunder Bay shipped 3.6 million tonnes compared with 3.5 million tonnes the previous year.[66] The geographic location of demand is always an important determinant of the direction of grain movement however, a number of other factors have been cited as contributing to this strong performance. According to the Port of Thunder Bay, 20 new ocean going vessels (salties) which are capable of loading grain started coming on stream in 2011. In the past two years, the tripling of "project cargo" delivered to Thunder Bay on salties has provided a substantial increase in capacity for back-haul grain cargo. This capacity will soon be further supplemented by 15 new lake vessels that are currently on order.

Major grain companies with country collection facilities all have substantial investments in terminal and transfer elevators at Thunder Bay and in the Lower St. Lawrence Seaway. Since 1 July 2011, Viterra has been leasing the grain terminal owned by the Montreal Port Authority. These commercial entities have a vested interest in ensuring throughput and therefore profitability of their eastern networks. The CWB previously programmed a substantial winter rail program to the terminal elevators at Montreal and Quebec City. Winter rail to eastern points has been minimal thus far in the first year of the open market, further supporting the theory that grain companies want to utilize their Thunder Bay assets. Interest in shipping U.S. grain through Thunder Bay has also been increasing in recent years.

Environmental Risks

As noted in previous sections, Canada is challenged by its climatic conditions and exposure to seasonal changes unlike any other grain producing nation in the world. A generally reduced plan for rail shipments and ship loading at ocean terminals occurs in the winter months due to expectations of reduced railway capacity due to winter conditions and reduced port throughput capacity due to weather related ship loading delays on the west coast.

The availability of inland transportation is subject to weather conditions. For example:

- The reduced efficiency of trucking operations to primary elevators in inland areas due to the imposition of annual spring road ban limits
- The closure of the St. Lawrence seaway due to ice conditions between December and March
- The necessity to reduce train length in severe winter conditions

One of the most challenging aspects of winter climate is the impact it can have on railway operations. When temperatures fall below -25C, a railway must reduce the length of trains 15-20% of their normal operating length. For example, a train that is normally 6,000 feet will be reduced to 4,500 feet and an 11,000-12,000 foot train will be reduced to 7,000 feet. This significantly reduces a railway's capacity.

The primary reason for this reduction is the ability for the train to hold air in its brake lines in the face of colder air temperatures. Each railcar has flexible rubber hoses at each end that are joined when the train is brought

[66] This represents the largest volume handled at Thunder Bay since the 2000-01 crop year when 3.8 million tonnes were moved.

together. This allows air that is pumped by a compressor in the locomotive to be fed to each cars braking system. When the temperature falls, the ability for those connections to completely seal themselves is severely reduced, particularly as the train length is increased. The solution is to reduce the number of cars in the train and thereby reduce the number of connections.

A solution often employed by the railways is the use of mid-consist locomotive power or compressor cars. While this serves to mitigate the problem of air flow to the braking system, it has limitations that still require a reduction in the length of the train.

Railways are also challenged throughout the winter months as avalanches occur in the mountains. CP Railway representatives pointed out that they were required to halt operations through the mountains for avalanche mitigation 25 times during Q1 of 2011, which according to CP was far in excess of normal winter operations.[67]

Labour

Human resources are critical to all supply chains. Stakeholders identified a number of challenges related to the labour-management relationships in some portions of the grain supply chain.

Where labour works within a collective agreement, the conditions of those agreements may limit the flexibility and efficiency of the supply chain. The following section provides a high level description of the labour-management relationship for railways and grain companies (at both country elevator and port terminals).

Country Elevator

With the exception of Viterra, country elevator labour is not unionized. Locally hired, they will fall into a few classifications typically grain buyers and inspectors, operations labour and administration. Viterra operation and maintenance (country operations) and Regina office workers are members of the Grain and General Service Union (Under the International Longshore Workers Union). Both groups have recently ratified three year contracts covering the period to 31 October 2015.

The process of gathering grain into the grain handling and transportation system (GHTS) starts with the commercial relationship between the producer and the grain buyers. Grain buyers will work 10 – 13 hour shifts (dependent on company) grading and classifying the grain and ultimately making the commercial agreement with the producer. These positions are skilled staff trained on the job. They are in demand as a good buyer will enhance the profitability of the elevator.

Operational labour is normally hired on the basis of a 40 hour work week, the majority of whom will work Monday to Friday (the typical time frame preferred by producers for the delivery of grain). Some shifts will be scheduled through the weekend to accommodate grain delivery and the loading of trains.

Evening and night operations are rare with the exception being the cleaning of grain. As this is a period of time when few grain deliveries occur it allows the elevator to prepare product for planned loading to railcars.

The weekend loading of trains is often a challenge. A full shift and staff complement must be scheduled when railcar loading falls outside of normal hours requiring the elevator to schedule incremental workers. While most workers will welcome the overtime opportunity, railways' failure to deliver empty railcars in the scheduled timeframe frustrates employees and can result in significant costs to the elevator. Further, Labour

[67] According to Environment Canada data, snowfall at Revelstoke, the location of major CP rail facility in the mountain corridor in BC, in 2011 was 85% higher than it had been on average in the previous two years – supporting CP's claim that delays due to uncontrollable weather events were more significant than normal in 2011.

Canada regulations limit total hours worked by operational labour to 48 hours each week. As a consequence this becomes a challenge for some elevators as multiple failures in a week can result in labour shortages for the elevator.

Labour retention has become a challenge for country elevator management in recent years. As the oilfield and oil sands industries in Western Canada have grown it has become increasingly difficult to compete in the skilled labour market due to the higher wages and benefits available in the oil industry.

Port Related

Port terminals are persistently challenged both internally and externally on ways to increase terminal throughput capacity. Managing a fluctuating workload within a port terminal operation requires careful balancing of throughput performance against costs.

The Grain Workers Union (GWU) workers are a fixed staff contingent and there is limited ability to scale the workforce size on short notice. Terminals will manage short-term spikes in volume by adding additional shifts using staff on overtime. This is a limited scenario as each employee can average only 8 hours of overtime per week.

Port terminal management does not have the option of calling staff in from a crew board arrangement such as railways or long shore workers. They must work with labour that is posted to permanent or semi-permanent positions. Therefore, long-term additional throughput capacity at a port terminal can only be added in large increments. To create a full additional shift, say for unloading of railcars, would require the establishment of six positions and a job posting process that can take up to eight weeks. The challenge in this circumstance is to ensure that enough incremental volume exists to support the cost associated with the incremental staff levels and that other shifts are not sub-optimized in the process.

The challenge for the management of Canadian Grain Commission (CGC) labour is not unlike port terminal GWU labour as it relates to managing the fluctuations around peak volume demands, weather and other labour union complications.

An annual reduction in operations at west coast elevators has been observed during the Christmas period, with correspondingly reduced rail service

Loading of grain vessels in adverse conditions, particularly during rainy periods, has been an issue for over 10 years. The decision of when loading of grain to a vessel can occur ultimately lies with the ship's captain. Under normal conditions the captain determines if precipitation levels present a risk to the integrity of the ship or cargo and if so stops loading and covers the vessel's hatches. When such an event happens, loading activities stop and the longshoremen are sent home. They are however paid for a full shift.

Precipitation is plentiful on Canada's west coast, particularly during fall and winter peak shipping months, and consideration is always given by the captains to balancing risk with efficiency. Despite this, the loss in productivity due to rain is considered to be a significant problem at the port. Port terminal operators and stevedoring companies have conducted trials using tarps to cover the hatches in order to allow loading to continue on rainy days. The BC Maritime Employers Association (BCMEA) with the support of Transport Canada contracted with SNC Lavalin to undertake a study on the operational options and safety of loading grain vessels using tarps. That study recommended processes and operational techniques that ensured the safe and continuous loading of vessels in the rain.

The International Longshore Workers Union (ILWU) responded to these initiatives by insisting a fourth person would be required in each loading gang if tarps were to be used while loading in the rain. They contend this is necessary for safety reasons as there are risks associated with slippery ship decks and fire hazards posed by grain dust exhausting from holds during loading (although the SNC Lavalin processes include safe

ventilation techniques for the exhausting of dust). In 2013 the stevedoring companies came to an agreement with the ILWU that sees the fourth person on the loading gang added during periods of rain. Further, all parties concerned have moved forward in the loading of grain using tarps and hatch covers which has all but eliminated the loading delays incurred because of rain.

The terminal operators have recently been confronted by a Canadian Human Rights Board decision involving age discrimination related to mandatory retirement. The average age of GWU workers is presently in the 55-60 year old range. With the removal of mandatory retirement, a number of employees have officially stated their intention to continue working after age 65. This presents a challenge for terminal operators as many of the positions held by GWU workers are of a nature requiring significant physical endurance. As the average age of the terminal employee increases it is expected this will have an impact on terminal productivity as health challenges will have to be accommodated through such programs as modified duties and reduced hours of service.

Three different unions represent employees supporting grain port terminal operations: the Grain Workers Union (GWU), the International Longshore Workers Union (ILWU) and the Public Service Alliance of Canada (PSAC).

The port terminal operators' unionized employees, represented by the GWU, play the lead role in handling grain at port on behalf of the owner or shipper of the grain. The terminal is responsible for unloading railcars or trucks for further processing and storage. The additional processing includes cleaning and drying of the grain if necessary and the classification and blending of the grain for holding until vessel loading is required and the assembly of grain to the conveyors leading to the vessel being loaded.

Canadian Grain Commission workers in port terminal operations are represented by the Public Service Alliance of Canada and are divided into two bargaining units (weighers and inspectors).[68] Until August 1, 2013, the Canadian Grain Commission was responsible for weighing and inspecting the grain that was unloaded at the terminal, as well as the weighing and inspection of the grain loaded to ocean and lake vessels. This process establishes the official record of grains arrived at port and those that are exported. The CGC also provides the official certification of the specific contents loaded to a vessel (Certificate Final).

The inspection process for grain unloaded at the port terminal was also performed by port terminal staff who also determined (confirmed) the grain, grade, protein and dockage level of the grain being processed. The terminal staff then processed the grain and readied it for loading to a vessel based on the specifications as stipulated by the grain's owner or shipper[69].

By agreement Vancouver terminal operations staff work seven and one-half hour shifts Monday to Friday. Staff will rotate from terminal to terminal – some by shift and some by week. This is to ensure no long-term relationship or the appearance of one, is established between CGC workers and the terminal staff. Work on weekends is performed on an overtime basis and advance notice must be given.[70]

Thunder Bay operates under the same structure and plan as Vancouver however staff shortages will often mean CGC staff are not available on afternoon or other non-regular shifts. Arrangements have been made

[68] As of April 1, 2013 in Thunder Bay and East the CGC no longer had operational weigh staff. As of August 1, 2013 concurrent with their move to the "Weighing Oversight and Certification Program" that will be the case across Canada.

[69] Terminal staff has continued to perform inspections of grain unloaded in the post Aug 1, 2013 period. They now report their findings daily to the CGC

[70] Overtime on a Friday must be given by noon on Thursday and weekends by noon on Friday.

with terminal management that allow GWU workers who weigh the grain unloaded from railcars and loaded to vessels to collect data on those activities for subsequent entry into the CGC accounting systems.

Given its short work season, Churchill is not permanently staffed. Short-term assignments are established and staff is recruited to work 10 to 14 day turns. These employees are typically called from the ranks in Thunder Bay.

In Eastern Canada permanent staff is located in Chatham, Montreal, Quebec City, Baie-Comeau, and Port-Cartier. When unloading or loading activities are scheduled for transfer elevators in the Upper Seaway, they are serviced by staff from the office in Chatham. In the Lower Seaway, the other transfer elevators (Sorel, Trois Rivieres, and Halifax) are normally served with staff from alternate locations.

The owner or shipper of the grain (or their agent) contracts a stevedoring company to coordinate the loading of the grain to the vessel. The stevedoring company, whose employees are represented by the ILWU, is responsible for developing a load plan for the vessel, coordinating multiple terminal berths when necessary and the physical loading of the vessel. The stevedores possess the critical understanding of the specific vessel design, buoyancy and maritime operational needs required to optimally and effectively load product to ships.

ILWU workers are hired and coordinated through the stevedoring company hired by the owner or shipper of the grain (or their agent). Because of the irregular schedule of the vessel arrivals needing unloading or loading at a port, the nature of long shore work is not conducive to fixed staff levels at specific terminals. In Vancouver, Thunder Bay and Prince Rupert ILWU workers are managed through a union hall call out.

When a loading schedule is established for a grain vessel at a terminal (a coordinated process between the terminal and the stevedore), the stevedoring company will determine the number of gangs (a gang consists of 3 people – a foreman and two longshoremen) required for loading a vessel and puts a call out through the hall. The hall will call workers based on a seniority process and assign the work. The workers will then report to the specific terminal for the ship's loading. Depending on the size of the ship to be loaded 2-3 gangs may be required.

Railway Labour

There are two labour groups directly involved in railway train operations. Locomotive engineers and conductors, track maintenance workers and rail traffic controllers are represented by the Teamsters Canada Rail Conference (TCRC) and rail car equipment workers are represented by the Canadian Auto Workers (now Unifor).

Mainline and Road Switching Running Trades

The variable nature of mainline train schedules result in the planning and management of running trades employees using a pool or "board" system. Railways will determine the total number of employees required based on a traffic forecast and calculate the total number of personnel required for a given period of time (the timeframe will shift from terminal to terminal and railway to railway). The total number of locomotive engineers and conductors is set for a specific "board" and employees will bid onto the specific board.[71] The board consists of a list of qualified personnel in each of the locomotive and conductor trades. The initial listing starts in seniority order and train crew assignments are filled by calling personnel from the list in order of seniority and availability. Any given terminal can have a number of crew boards, one for each major direction that main lines run from a terminal. In order to provide a form of surge capacity, many terminals will have a "spare

[71] A crew "board" is set for a specific geographic area, usually one or two railway subdivisions, and consists of a list of the senior most qualified applicants for that board in a given period of time. The time frame is usually for 1-3 months.

board", which consists of more junior employees who are called for work when the main boards run short of personnel.

A typical work day for a train crew is 10 hours, with extensions up to 12 hours under exceptional circumstances. A crew member must have an adequate period of rest before they can return to work and have their name appear on the board to be called for their next assignment.

The establishment of the "right" number of employees assigned to a board is important for the railway. If a board is set with too many employees, it means that all of the employee resources on the board will not be fully utilized and the railway must pay them out at the end of the period. If too few are assigned, the railway could run short of crews and not have adequate resources to run the trains required.

Further, the call list can be impacted by the actual availability of employees, whether they have had a long enough rest since the last trip worked and if they have worked the maximum number of hours/ trips in a given period. Other external challenges include line outages or weather related delays.

Car maintenance mechanics are scheduled in the same fashion but assigned to specific shifts. The number of employees is set on the same workload forecast as train crews. Each train must be inspected prior to its departure and having adequate inspection staff in place is essential to the timely departure of trains.

The major impact on crew boards though is the appearance of unscheduled traffic or movements not originally anticipated in the workload forecast. Railways plan for some surge in demand and, like others in the supply chain, will attempt to anticipate workload levels as best possible.

Market Power

Shippers have long complained about the imbalance in market power and the need for balanced accountability within the commodity shipping environment, an issue that extends beyond the grain industry to most other shippers of bulk commodities in Canada.

In the case of the grain industry, with only four of the 392 primary and process elevators in western Canada being serviced by both Class one carriers, grain companies are essentially captive to one or the other of the two major railways. Shippers complain that the railways have no incentive to compete for their business and prefer to level the grain volumes over the entire crop year as opposed to provide the capacity necessary to meet the market demands in the time period corresponding to customer buying practices. Through their efforts to gain better asset utilization of all their resources, the railways' ability to deal with surges in volume has diminished and the time required to recover after line outages and weather related slowdowns become much longer, all having a detrimental impact on the system's ability to deliver grain, and ultimately, on the country's reputation as a reliable supplier of grain in global markets.

An example of the railways recoverability can be seen in the change in the week to week volatility of change in unloads at port. In Figure 18, the total unloads averaged in four year groupings are shown. In the period between 2001 and 2005 changes from week to week can be seen to be far less drastic than in the later two four year periods. This suggests that over time, the volatility of railway delivery has become more extreme and their ability to recover from periods when disruption is likely to occur, particularly in the winter periods (between weeks 18 and 30 are greater). It is also fair to note that over this period of time railways have added capacity and are handling greater volumes.

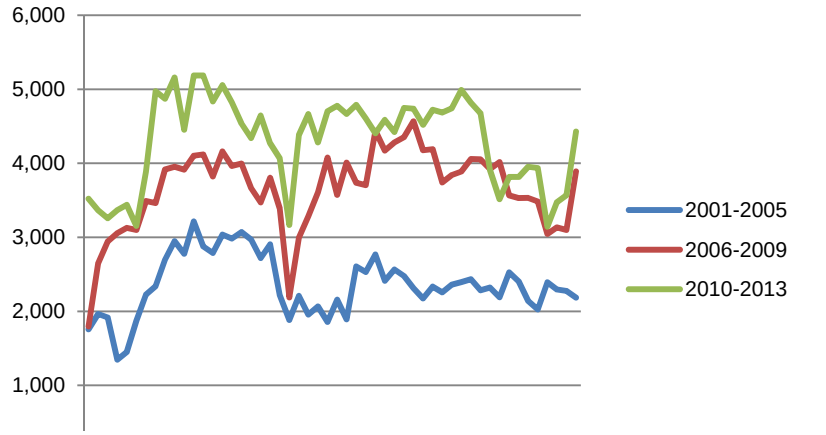


Figure 18 - Weekly car unloads at West Coast ports grouped in four year averages

Regarding balanced accountability, the current regulatory environment allows railways to charge shippers for any performance shortfalls. Examples are the loss of multi-car incentives and car demurrage if cars are delayed at point of loading or unloading. In consultations held for this study, shippers point to the fact they have no ability to charge for, or recoup, losses incurred due to railway performance shortfalls. Scenarios that can result in significant labour costs and/or loss of overall productivity are when cars are not spotted on schedule or are delivered to destination having been delayed or split into inefficient blocks. They further point to their only recourse being the shipper protection measures within the CTA, which can be extremely time consuming as well as costly in terms of legal and analytical support.

Summary

There are several areas of risk in the Canadian grain supply chain that have been long standing challenges for the industry. Many, such as labour issues, are shared with other competitor countries, while others such as geography and climate are unique to the Canadian supply chain.

The changes relative to the marketing of Canadian grain, with the elimination of the Canadian Wheat Board's single desk and the changes in buyer expectations and demands will present a new set of challenges for the Canadian industry in the coming years.

With all that said, it is apparent that the industry itself is keenly aware of the challenges that exist as well as those coming in the future and has moved forward with intentions of dealing effectively with them. A common theme amongst all participants is the goals of having Canada's grain supply chain respond to the challenges, ensuring it is the best in the world.

Opportunities

Canadian grain supply chains will always be challenged due to the natural variability of crop production, and limited capacity of the system, dynamic commodity markets, and most significantly Canada's vast geography and extreme and unpredictable climate. However, there are many feasible opportunities to improve the effectiveness and reliability of Canada's grain supply chain. The study team in conjunction with supply chain stakeholders identified the following three areas of opportunity:

1. Visibility and transparency
2. Capacity and Reliability
3. Balanced Accountability

Visibility and Transparency

Improving the visibility and transparency of the Canadian grain supply chain empowers supply chain participants to optimize their transportation and logistics strategies in a number of ways. Two major areas of transparency that were recommended by stakeholders were:

- The development and provision of a wider range of statistics, information and measures on the current performance of the supply chain. This would include the proactive identification of potential or current bottlenecks in the systems. In doing so, all stakeholders would be able to better plan their operations and traffic flows.
- The development and implementation of a process to see the exchange of both forecast demand and system capacity information between all stakeholders.

The benefits as noted by stakeholders who were interviewed through the studies group and individual sessions indicate that notable reductions in operational costs and penalties, such as overtime and demurrage could be realized. In addition, it would enable agricultural shipper's ability to better predict shipment times. This is important from a competitiveness perspective as unreliable arrival dates have been a major concern for Canada's international buyers.

In the discussions between stakeholders in both the working group sessions as well as the one on one interviews, a number of areas were raised as potential opportunities for improvement in the area of visibility and transparency. These are discussed below.

Improved Performance Measurement

Supply chain visibility can be enhanced through more frequent and comprehensive demand and performance metrics. Performance measures are integral to improving the efficiency of the grain handling and transportation system by enabling more accurate forward planning and providing early indications of when and where the supply chain may be weakening.

The key performance measures identified by stakeholders were:

- Rail car supply and demand data
- Rail capacity data
- Port capacity data

- Vessel line-up and arrival information at major ports [72]
- Weekly sales and stocks (tonnage) information.

Timely access to these measures would increase the efficiency and competitiveness of supply chain stakeholders, as they could better gauge the level of demand for both product and the system's logistics capacity and adjust their forward operations accordingly. These measures would be particularly valuable to exporters who do not own assets at port (or in the country). As a result, shippers would be able to more accurately estimate time of arrivals which would reduce penalties for missed arrival dates. Improved forecasting would also help to rebuild Canada's reputation for reliability in world markets. In addition, access to accurate data on sales and stocks would reduce the potential for over selling as stakeholders would have a collective understanding of both the tonnes available for sale as well as the tonnage that has been committed for sale to ensure that sufficient stocks are available.

Shippers also identified that current measures of the grain supply chain should be expanded to include a view broader than just Western Canada, and should be expanded into performance areas such as supply of capacity and trans-border movement amongst others.

Achieving a greater level of transparency through enhanced supply chain performance measures requires the coordination and cooperation of rail, country and port terminal operations supported by the exchange of information and data between the stakeholders. Grain supply chain participants should continue to work on the development of shared metrics that are transparent, timely, and credible from farm gate to vessel.

Improved Supply Chain Processes

Increased visibility would create opportunities to improve supply chain processes, and the ability to assess if current processes are effective, to ensure that supply chain participants are behaving equitably and properly following the various agreed upon processes. While opportunities for process improvements exist throughout the supply chain, four key processes were identified by stakeholders, two of which are distinct to container shippers.

Shipper & Railway Communication: Car Orders

An improved communications process between railways and shippers with regard to rail car supply, allocation and spotting times would enhance the shippers' ability to optimally plan and execute their logistical activities. In addition, shippers should avoid phantom orders as it creates inefficiencies in the railways' supply planning process.

Shippers desire the ability to receive accurate and timely communication from the railways regarding the status of their car orders. If railways and shippers were to work together to develop a communications strategy that allows both parties to effectively manage their assets and labour costs, it is generally agreed that improvements in both stakeholders operations would be realized. It is generally agreed that a lack of communication leads market participants to increase order lead times to compensate for uncertainty, which contributes to Canada's potential loss of reputation for reliability in world markets.

[72] The closure of the CPCA has created a void in information for grain traders who relied on this data to understand the forward demand and future capacity constraints in the port terminal network.

Terminal authorization processes

Both bulk and container shippers believe that the disciplined use of terminal authorization processes would ensure that no traffic is shipped to port terminals without a corresponding sale and vessel commitment. Several stakeholders have suggested the option of 'take or pay' contract conditions with any grain exporter using west coast port facilities particularly during times of congestion (i.e. peak volume periods).

It is a common belief of many stakeholders that with better transparency and predictability of system capability shippers and port terminal operators may pursue more effective strategies to exchange trading positions and pursue mutually beneficial asset utilization during periods of disruption.

Container booking process

Generally, there are no direct financial consequences to shippers for failing to utilize a container booking and there are no direct consequences to shipping lines for failing to provide a container against a booking. Stakeholders feel there is a lack of accountability on both sides of the container booking process. This lack of accountability can result in vessels departing "light" due to no shows on confirmed bookings, containers not being available for shippers with valid bookings and the over booking of container space by shipping lines. It also results in periodic congestion at transload facilities due to a combination of bunching of traffic in transit to transloaders and shipments being directed to transloaders without either terminal authorization or valid container bookings.

Port reservation systems

The current systems and processes for gate appointments reservations at Vancouver port container terminals are not perceived to result in a fair allocation of reservations to users with legitimate container bookings. The issue of gate appointments by truckers and the time truckers wait to drop off and pick up containers at port terminals, particularly in Vancouver, has been a long standing issue.

Over the past years, the entry system has evolved from a first come - first served system, to an internet based reservation system that allows a trucker to book a time in advance. The four terminals in Vancouver all have independent systems that opens daily at a specific hour (around midnight but varies dependent on the terminal). When the system opens, truckers then log in and reservations are booked until all the time slots run out.

Specific to the terminals within Port Metro Vancouver is the issue of access for trucks hauling empty and loaded containers to the four major container terminals located there, an issue that has resulted in a number of work stoppages and job actions against truckers and port terminal operators. Two issues specifically raised by stakeholders in the working group session were:

- The booking of block reservations by major shippers that are done without accurate booking references and often allow carriers to pick up more containers than are required, leading to shortages for operators with legitimate needs;
- The approach to making reservations used in some instances places burdens on drayage operators and encourages gaming the system. Specifically, this refers to the "draw" approach to obtaining a reservation and encourages truckers to make multiple reservations in order to ensure they get a slot in the terminal queue. This has been tempered somewhat by terminals who require that a reservation include a shipping line's booking reference number, although it reportedly does not entirely alleviate the problem of block booking.

There have been some significant steps taken over the past two years to address these issues:

- An initiative by Port Metro Vancouver was established to equip all trucks with GPS communications technology as well as working towards integrating the reservation systems across the four terminals. All trucks were completed in June of 2014.
- The port, in conjunction with the Provincial and Federal governments has established a committee (the Container Drayage Leadership Team) which includes the container terminals, Western Canada Shippers Coalition, the BC Chamber of Shipping and the BC Trucking Association. The goal of the committee is to establish long term solutions for the drayage sector.

Capacity and Reliability

The capacity of the Canadian grain handling and transportation (GHTS) system limits the reliability of the system. Stakeholders argue that the GHTS does not have the necessary capacity to move, handle and store the volume of grain within the peak period. Therefore, any operational interruptions have the potential to create major delays for multiple shipments. The limited capacity also effects the system's ability recover from disruptions in a timely manner. The capacity argument can be applied to almost every stakeholder in the grain supply chain: producers, country elevators, railways, terminals, and ports are all limited by their level of capacity and their ability to effectively utilize their assets. Many opportunities exist for the GHTS to increase its capacity and subsequently improve its reliability and recoverability.

Stakeholders have encouraged the continued investment in strategies to mitigate predictable and controllable events. Recent examples of these can be seen in projects such as: the establishment of processes, agreements and infrastructure of rain covers for vessel loading on the west coast; and the expansion plans for terminals and the adjacent improvements in both road and rail access to terminal facilities at the Port of Vancouver. Industry should continue to invest in projects, infrastructure and processes that have the opportunity to improve the capacity and reliability of the grain supply chain.

In Canada the rail system is integral to the grain supply chain as the average rail haul from inland elevator to port is about 1,500 km, through difficult geography and seasonal climate changes that can at times create incredible operating conditions. Consequently, Canada is at a disadvantage to competitor countries whose access to ports of export is much shorter and with fewer constraints. With a continued focus on improved asset and resource utilization directed at improved profitability, the ability of railways to provide increased capacity or recover from times of disruption has been challenged in the last few years. Further, as railway capacity becomes more constrained, they must turn to rationing of that capacity in times of higher market demand. This has the compounding effect of increasing the challenges for the supply chain.

As railways have increased their focus on improved profitability through increased asset utilization, limited access to rail capacity has intensified. Many shippers believe that access to rail capacity is regulated by the monopoly/duopoly structure of the rail transportation market and is therefore not based on market mechanisms.

Balanced Accountability

Due to the interconnected nature of grain handling and transportation system, the performance of individual members of the supply chain directly affects the operations of the entire grain supply chain. This creates challenges as congestion caused by one stakeholder's behaviour is not necessarily borne by the stakeholder. Compounded actions occur frequently and are not isolated to any single stakeholder group, the most common examples include: railways failing to supply committed railcars creates congestion at the country elevator and impact the grain company's sales programs; country elevators changing destination ports once the cars are loaded often conflicts with the railways' resource plans; railways breaking apart car blocks so as to consolidate and increase train length results in port terminals receiving cars out of sequence and often impacts vessel loading plans; and port terminals calling in cars out of the sequence they were released in

the country and/ or arrived at the destination thereby causing congestion and additional switching in the railways' yards.

A principle carried by shippers throughout the railway service review and echoed through the consultation process for this study is the perceived imbalance of accountability between railways and shippers. Railways, through their ability to utilize published tariffs and the nature of their own market position in the shipper–carrier relationship, can hold shippers financially responsible for their actions – or inaction as the case may be – through the use of demurrage fees and other penalties designed to enforce a discipline on shippers' actions and behaviour. Shippers on the other hand have no such means or mechanisms available to them to enforce discipline of behaviour upon the railways.

Shippers are hopeful that legislative changes may allow them to negotiate commercially balanced service level agreements with railways. In addition, shippers could continue to look to all other supply chain channels to increase their access to competitive alternatives if disruptions to rail service limit their future commercial opportunities. This includes flexibility in their use of rail and port corridors in North America.

In addition to the opportunities noted above, there have been two specific actions taken by the Government in the past two years that look to improve the opportunities for stakeholders in the grain industry.

Service Level Agreement Consultations and Bill C-52

In response to the Rail Freight Service Review Panel's report and recommendations in 2012, the Minister of Transport, Infrastructure and Communities announced a facilitation process between shippers and railways to develop a template service agreement and a streamlined commercial dispute resolution process. Subsequently, the Minister appointed Mr. Jim Dinning, to facilitate negotiations. In his final report, presented to the Minister in early June 2012, the facilitator indicated that while some progress towards these goals had been made, stakeholders were not able to reach consensus on all issues.

Mr. Dinning provided a draft service agreement template that he recommended be made available to all rail freight stakeholders as a tool to be used to negotiate service agreements between railways and their customers. He also provided a draft commercial dispute resolution process that he recommended Transport Canada make available to stakeholders.

As part of its response to the Rail Freight Service Review, the Government also committed to introducing legislation to improve the predictability, clarity and reliability of rail service in Canada. Bill C-52, *The Fair Rail Freight Service Act* received Royal Assent on June 26, 2013. It is intended to provide railway customers with the right to a service level agreement with the railways. It includes provision for arbitration overseen by the Canadian Transportation Agency to allow shippers to obtain an agreement if commercial negotiations fail.

Crop Logistics Working Group

Originally established in 2011 to give a broad cross section of organizations in the agriculture sector the opportunity to provide input into marketing freedom and the Rail Freight Service Review implementation process, the Crop Logistics Working Group's (CLWG) mandate was extended on November 20, 2012. The renewed objectives of the CLWG were: supporting innovation in the GHTS; identify enhancements to improve competitiveness; develop performance metrics and public reporting; and provide a forum for stakeholders to exchange views and information on supply chain issues.

In general, stakeholders agreed that to improve the reliability of Canadian grain supply chains, action needs to be taken in areas that will improve the visibility of system demand, capacity and performance and provide mitigation strategies for disruption events. Participants understood that even with well-

designed mitigation strategies, these events are bound to occur in a system that operates in dynamic commodity markets across Canada's vast geography and sometimes harsh and unpredictable climate.

Conclusion

Understanding the many components and complexities of the Canadian grain supply chain is essential to maintaining and improving the system. An efficient, well-functioning grain supply chain is critical to supporting Canada's economic interests. While the grain supply chain has undergone a number of important changes that have altered the way grain is sourced and moved in Western Canada, all participants in the supply chain can contribute to optimizing the system while maintaining their commercial and operational positions.

In the past decade the grain sector has experienced changes in infrastructure, legislation and market demand. Infrastructure changes include the consolidation of grain companies as well as the of the country elevator system. There has also been growth in short-line and producer car operations, and the number of container transloading facilities in the country and at port has increased.

The federal government also made changes to the many laws that impact the grain supply chain. The most recent of these were *The Fair Rail Freight Service Act* which provided railway customers with the right to a service level agreement with the railways. *The Canada Grain Act* was amended to eliminate inward inspection at terminal elevators and to allow for an insurance-based producer protection system.

The Marketing Freedom for Grain Farmers Act removed the CWB's monopoly on the marketing of Western wheat, durum and barley, made the CWB a voluntary grain marketing entity and removed its authority to direct the movement of grain.

Grain marketers and buyers are increasingly sophisticated about the specific characteristics of grain that they buy. Market demands and opportunities have driven greater levels of distinction between the different varieties and grades of grain products. With the diversity in crops and grain products, the logistics of the movement of Canadian grain and its products are now more diversified. The increased diversity of grain products exhibited in the increased volume of special crops and value-added processing for special crops and oilseeds has also changed the way grain and grain products are marketed, sold and transported within and from Canada.

The challenges faced by grain supply chain participants have been well-documented through their testimony before Parliamentary standing committees, consultations and studies such as this. The immediate opportunities the sector needs to address – visibility and transparency; capacity and reliability; and balanced accountability will improve the system as a whole and thus benefit its participants. Work along these themes has already begun. The CLWG has prepared reports on performance measurement, building capacity, and innovation. Transport Canada will be establishing a Commodity Supply Chain Table to provide a forum for exporters to address issues that affect the freight logistics system and help develop supply chain performance metrics.

If there is one point of agreement between all stakeholders in the supply chain it is that the market must grow and that to grow, the capacity in all parts of the system must be increased, invested in and managed in a manner that see supply chain processes better aligned and communication between parties open and transparent. There is general agreement amongst stakeholders that enhanced transparency and collaborative process management will lead them a long way to reaching that goal.

Appendix 1: Stakeholder Participants

Agriculture and Agri-Food Canada
Alberta Agriculture
Alliance Grain Terminal Ltd.
Canadian Canola Growers Association
Canadian Grain Commission
Canadian National Railway
Canadian Pacific Railway
Canadian Ports Clearance Association
Canadian Special Crops Association
Canadian Wheat Board
Canola Council of Canada
Cargill Limited
CWB
Grain Growers of Canada
Great Western Railway Ltd.
ICE Futures Canada, Inc.
Inland Terminal Association of Canada
Keystone Agricultural Producers
Louis Dreyfus Canada Ltd.
Mission Terminal Inc.
OmniTRAX Canada, Inc.
Parrish & Heimbecker Ltd.
Paterson Grain
Port of Churchill
Port of Halifax
Port of Montreal
Port of Prince Rupert
Port of Thunder Bay
Port of Vancouver
Prince Rupert Grain Ltd.
Richardson Pioneer Ltd.
Saskatchewan Association of Rural Municipalities
Statistics Canada
Transport Canada
Viterra Inc.
West Central Road and Rail Ltd.
Western Grain Elevator Association
Weyburn Inland Terminal Ltd.
Wild Rose Agricultural Producers

Appendix 2: Glossary of Terms and Acronyms

Back haul	Traffic flows are normally viewed in terms of their origin - destination movements, and a flow viewed as "to the destination and back". One direction of the movement will have a lower degree of demand than the other (for various reasons) and will therefore command a lower freight rate than the other. It is referred to as the "back haul"
Balanced Traffic Flow	A balanced traffic flow refers to balance between the volumes flowing in versus those flowing out. An optimally balanced flow would have 100 loaded containers moving into a terminal and 100 loaded containers moving out.
Basis	The spread, or difference between the relevant nearby futures month price and the country price for the commodity
Blocks	A "block" in railway terminology refers to a grouping of railcars whose intended destination is the same. For example, a train from Vancouver to Toronto will have cars (or containers) for cities it passes through along the way. The railway will "block" each cities' traffic when the train is built in Vancouver (place all the Edmonton destined cars together, the Winnipeg cars together, etc.), so as to reduce the amount of switching at each stop along the way.
BNSF	The Burlington Northern Santé Fe Railway is Ft. Worth, Texas based Class 1 railway whose territory extends throughout the western US states and into western Canada.
Bulk Handling	Refers to movement of material en masse in large mobile containers (railcars, containers, vessels) in contrast to transporting material in bags or packages
Bushel	Imperial volumetric dry measure equal to 4 pecks, 8 gallons, 32 quarts or 64 pints
Cabotage	Cabotage refers to the regulations and tariff exemptions covering the use and importation of international containers into Canada. It commonly refers to the regulations surrounding a container's exit from the country within 30 days of its entry.
Cash purchase ticket	A document in prescribed form issued in respect of grain delivered to a primary elevator, process elevator or grain dealer as evidence of the purchase of the grain by the operator of the elevator or the grain dealer and entitling the holder of the document to payment, by the operator or grain dealer, of the purchase price stated in the document (*Canada Grain Act*); ticket indicating the grade, weight, price and amount payable to the owner of the grain for each delivery of grain to a primary elevator, process elevator or grain dealer; the ticket is a negotiable instrument and can be cashed at any chartered bank or credit union
Cereal	Any grain or edible seed of the grass family which may be used as food
Certificate Final	Certificate issued by the CGC for each cargo of export grain; the Certificate Final stipulates the grade and weight of the grain loaded on a vessel
Chassis	When a container is to be delivered to its destination it is placed on a chassis, effectively turning it into a common "semi-trailer". The chassis is configured such that the container can be "locked" on. It will normally remain on the chassis until it is returned to the terminal or to a storage yard.
CN	The Canadian National Railway is a Montreal, Quebec based Class 1 railway whose territory extends throughout Canada and the central US states.
Consolidation	The act of consolidating traffic is to take the lading from multiple containers, each of whose lading is destined to multiple locations and unload it, sort it to single destinations and then reload the resorted traffic destined to one location.

Container stack	Stored containers may be "stacked" on one another up to five high, as is commonly done in terminals and storage yards. Multiple groups of containers piled in this manner are referred to as "stacks".
CP	The Canadian Pacific Railway is a Calgary, Alberta based Class 1 railway whose territory extends throughout Canada and through the central US states.
CPRS	A type of wheat - Canadian Prairie Red Spring
CPS	A type of wheat - Canadian Prairie Spring
Cube	A common reference for empty equipment space in the transportation and logistics industry. For example an empty 20 foot container would be referred to as "20 foot cube"; or the logistics of moving empty containers to a location for loading is commonly referred to as "putting cube in position".
Deconsolidation	The act of deconsolidating traffic is to take containers of consolidated loads, unload and deliver that traffic.
Demand smoothing	The "smoothing" of demand refers to various actions taken to reduce surges of traffic that may cause imbalances in the movement of traffic in any specific traffic flow.
Demurrage	Money payable to ship owners or railcar owners for time used in excess of the agreed number of days allowed for loading and/or discharging; expressed in terms of dollars per day
De-stuffing	The unloading of lading from a container
Dockage	Means any material intermixed with a parcel of grain, other than kernels of grain of a standard of quality fixed by or under this *Canada Grain Act* for a grade of that grain, that must and can be separated from the parcel of grain before that grade can be assigned to the grain
Dray	The movement of container equipment from one location to another is referred to as "dray".
DRP	DRP refers to Domestic Repositioning Programs, which are predominantly managed by railways. They are intended to use international containers to move traffic from a domestic origin to a domestic destination in order to position the container at a location close to where either an internationally destined shipment can be loaded or the container can be evacuated from the country.
Evacuation	This refers to the act of a container being moved from the country empty on a container vessel. (i.e. "100 TEU were evacuated" means 100 empty twenty foot equivalent containers were loaded to a vessel)
Falling Number	The standardized measure for determining weather or sprout damage in wheat. It is one method of determining quality for use in bread and baked goods
Gate Operation	An integral part of any intermodal, port or container terminal requires a gate operation to allow the orderly entry and exit of containers. This part of a terminal operation is the most important control process for "in-terminal" container inventory
Gluten	A specific type of protein found in wheat and other cereal grains. It gives elasticity to bread and is another important measure of the quality of grain.
Gross weight	Weight of scale contents and container or tare
Head Haul	Traffic flows are normally viewed in terms of their origin - destination movements, and a flow viewed as "to the destination and back". One direction of the movement will have a higher degree of demand than the other (for various reasons) and will therefore command a higher freight rate than the other. It is referred to as the "head haul"
HRS	A type of wheat - Hard Red Spring
HRW	A type of wheat - Hard Red Winter
HWS	A type of wheat - Hard White Spring

HWW	A type of wheat - Hard White Winter
ICT	An Inland Container Terminal
Identity preserved	Involves maintaining the unique traits or quality characteristics of a crop from seed through transportation, handling until processing
Interchange	An interchange is the physical location where two railways exchange equipment. It is usually a siding or a small yard where two railways' rail lines intersect. The act of interchanging equipment refers to both a physical as well as procedural action that covers the exchange of billing information and the cars' lading records.
KIP	KIP is the standard reference to loading capability (1 KIP = 1,000 pounds loading). In the context of most intermodal design, the reference is to KIP's per square foot. In other words, the compression of the ground must be such that it is able to sustain and carry weights of up to 120,000 pounds per square foot.
Lading	The goods and traffic that are loaded in equipment to be moved from origin to destination.
Legume	Any of a large group of plants of the pea family characterized by true pods enclosing seeds; because of their ability to store up nitrates
Margin	A margin in this context refers to the difference between the revenue derived from a freight movement and the cost of performing the service.
Matchback	The shipping line industry commonly refers to "matchback" loads when dealing with movements in a back haul scenario. A matchback allows a container to move to a destination where a load (most likely a more remunerative one) is readily available for that equipment.
Moisture	Water that is contained as a natural constituent of most food and other biological materials
Motive power	The locomotive or group of locomotives required to pull a train.
Multi-Car Blocks	A railway term for the movement of several railcars from the same origin going to the same destination travelling on a train together. Usually referred to when an incentive is paid by the railway (for 50 and 100 car blocks on CN - 56 and 112 car blocks on CP)
Net weight	Means the accountable gross weight of grain less the amount of dockage specified on the elevator or grain receipt or cash purchase ticket issued in respect of the grain (*Canada Grain Regulations*); gross weight minus the tare weight
Oilseeds	Include flaxseed and solin, canola and rapeseed, soybeans, safflower and sunflower seed
Primary Elevator	As licensed by the Canadian Grain Commission, a country grain elevation facility whose purpose is to receive, blend, store and load to railcar for furtherance. Some primary facilities will also clean and dry grain.
Process Elevator	As licensed by the Canadian Grain Commission, a country grain facility whose purpose is to receive, blend, process in a value added capacity, store and load to railcar for furtherance.
Producer car	Railcar that is loaded and shipped by a producer to a terminal elevator; producers apply to the CGC to have a railcar allocated to them
Protein	An essential nutrient for humans and animals and is found in all grains and one of the chief constituents of plant and animal tissues containing carbon, hydrogen, oxygen, nitrogen and frequently sulfur; in wheat, protein quantity and quality are both important for baking and nutritional purposes. In grain, a higher percentage of protein indicates a higher quality
Pulses, pulse crops	Crops grown for their edible seeds, such as peas, lentils, chick peas or beans
Reefer	A container moving lading requiring controlled temperature service will most often require a refrigeration (reefer) unit.

Repositioning	In this context, refers to the movement of an empty container to a location where a load is waiting or can be secured.
Semolina	Product milled, usually from durum wheat, to coarse but uniform granulation; used to make pasta products
Setoff	Railway operations reference for the act of stopping a train between its origin and final destination to "drop off" a car or block of cars at an intermediate location. E.g. train 101 must "setoff" a block of 10 cars at Edmonton.
Slot	A railway intermodal operations reference for the space in a container car where the container is loaded.
Slot utilization	A railway intermodal operation reference and measure for the number of slots on a car, train or origin destination flow that have been used. This measure will commonly refer to empty slots, as well as empty and loaded containers loaded into the slots.
Special bin grain	In a primary elevator, special bin grain is held in a separate bin for disposal at the request of the owner; it is sometimes referred to as "identity preserved"; in a terminal elevator, special bin grain is held by authority of the CGC in bins registered by bin numbers in the owner's name
SRS	A type of wheat - Soft Red Spring
SRW	A type of wheat - Soft Red Winter
Storage Tracks	In this context, a railway operations reference for the tracks in, or close to, a terminal designated to store loaded or empty rail cars
Stuffing	The loading of lading into a container
Support Tracks	In this context, a railway operations reference for the tracks in or close to a terminal designated to switch and marshal cars into blocks as well as to construct or break apart trains.
SWS	A type of wheat - Soft White Spring
SWW	A type of wheat - Soft White Winter
Tare	Allowance made to the buyer of goods by deducting from the gross weight of a purchase, the weight of the container; the tare weight is subtracted from the gross weight to calculate the net weight of the product in the scale
Terminal Elevator	As licensed by the Canadian Grain Commission, a grain facility located at a port positions whose purpose is to receive, blend, process in a value added capacity, store and load to railcar for furtherance. Some terminal elevators also clean and dry grain.
TEU	A twenty-foot equivalent unit is a common reference used in the container industry and is based on International Standards Organization (ISO) specifications. For example, a 40 foot container = 2 TEU.
Tonne	Metric unit for expressing grain yield equal to 1,000 kilograms, or 2,200 pounds
Top-lift Unit	A large mobile crane that lifts containers on and off of rail cars, chassis and container stacks within a terminal. Raygo Wagner, Fantuzzi and Taylor are the three most prominent manufacturers of top-lift equipment in North America.
Tractor	A tractor refers to a truck tractor that hauls container chassis within a terminal and from a terminal to the consignee's location.
Train Blocking	A railway reference to the act of assembling blocks of railcars in a manner pre-determined by the train's design and intended to make the train's intermediate stops and final delivery more efficient.
Train design	A railway reference for the specifications that state the blocks a train will carry and the order in which they are to be assembled in that train.
Transloading	An industry reference for the movement of a shipment's lading from one mode of transport (domestic container or bulk railcar) to another (usually to or from an international container).

Unit train	String of contiguous railcars carrying a single commodity from one consignor to one consignee; the number of cars is determined by agreement among consignor, consignee, and the operating railroad
UP	Union Pacific Railroad is an Omaha, Nebraska based Class 1 railway whose territory extends throughout the western US states and south to Mexico. UP also connects to Canadian railways at Kingsgate, BC and through trackage rights with the BNSF to Vancouver, BC.
Wheat classes	The following wheat classes are produced in Canada and are graded according to specifications detailed in the Official Grain Grading Guide: Canada Western/Eastern Amber Durum CWAD CEAD; Canada Western Red Spring CWRS; Canada Western Red Winter CWRW; Canada Prairie Spring Red CPSR; Canada Prairie Spring White CPSW; Canada Western Extra Strong CWES; Canada Western/Eastern Soft White Spring CWSWS CESWS; Canada Eastern White Winter CEWW; Canada Eastern Red CER; Canada Eastern Red Spring CERS; Canada Eastern Hard Red Winter CEHRW; Canada Eastern Soft Red Winter CESRW
Working Tracks	In this context, a railway operations reference for the tracks that run through a terminal and from which containers are unloaded or loaded.

Appendix 3: Canadian Grain Exports

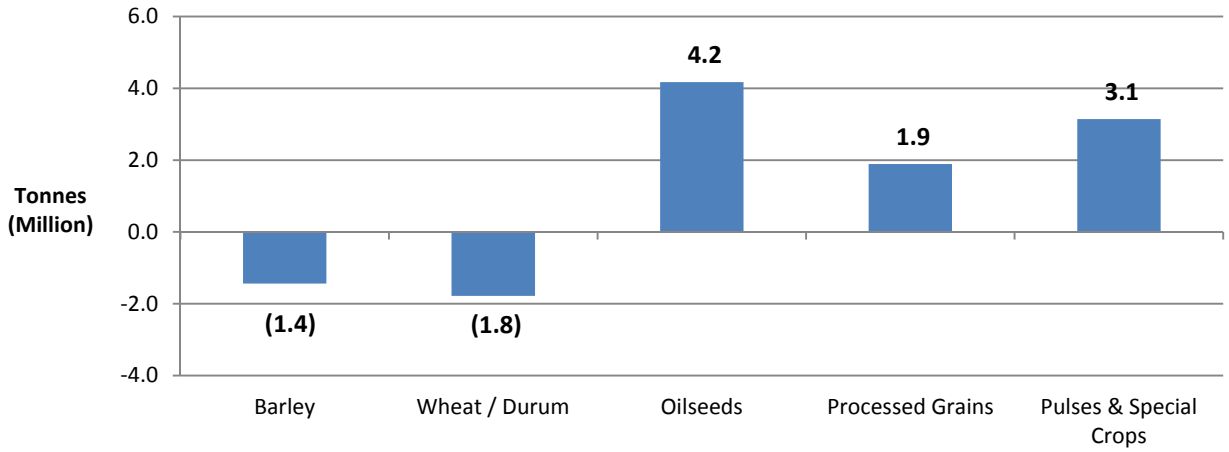
Asia

Asia remains Canada's most important export market accounting for 47% of total grain exports or approximately 20 million tonnes annually. Exports to Asia have grown by an average of 2% per year since 1990. There have been two significant changes in this market since 1990. First is the substantial decline in the dominance of China and Japan. Whereas twenty years ago these countries accounted for two thirds of the region's imports, with wheat, durum and barley accounting for more than 70% of those shipments, they now represent only 45% of Asian imports with absolute volumes remaining at 1990 levels. Equally significant is the change in commodities exported to these countries. Wheat, durum and barley imports have decreased by 5 million tonnes (76%) and have been replaced by 4.6 million tonnes of oilseeds, oilseed products and specialty crops.

Second is the explosive growth in exports destined to the Indian subcontinent and Western Asia – specifically India, Pakistan, Bangladesh, Sri Lanka, the United Arab Emirates and Saudi Arabia. These countries account for all of the net 6 million tonne growth experienced in the region as a whole during the last twenty years. Key growth commodities have been pulses and special crops (2.2 MMT), oilseeds and oilseed products (1.6 MMT) and wheat and barley (2 MMT).

Figure 19 below provides a summary of the shift in exports to Asia by major commodity group since 1990.

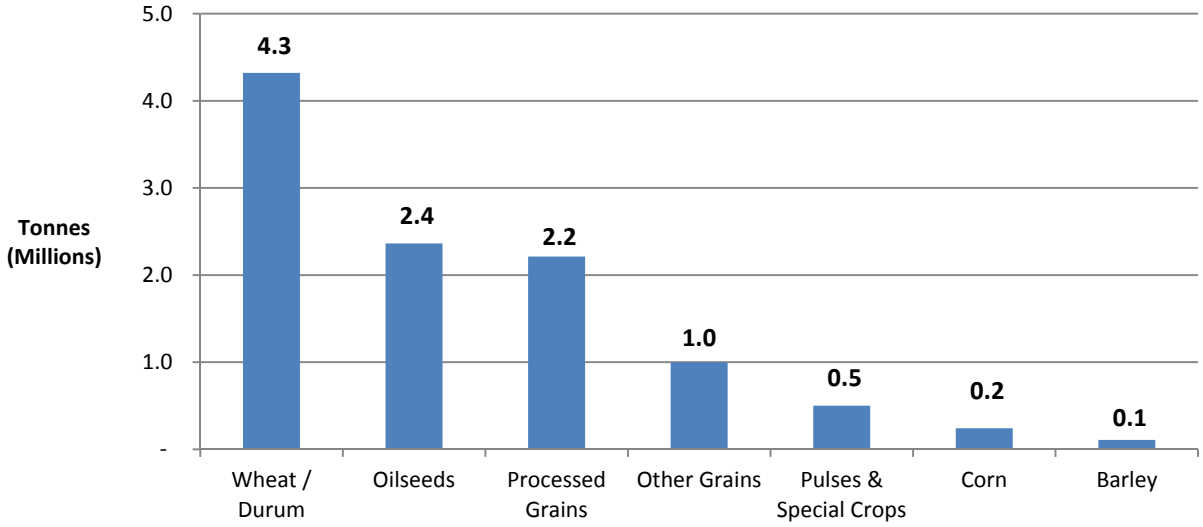
Figure 19: Changes in Total Grain and Grain Products Exports to Asia – 1990 to 2010



Western Hemisphere

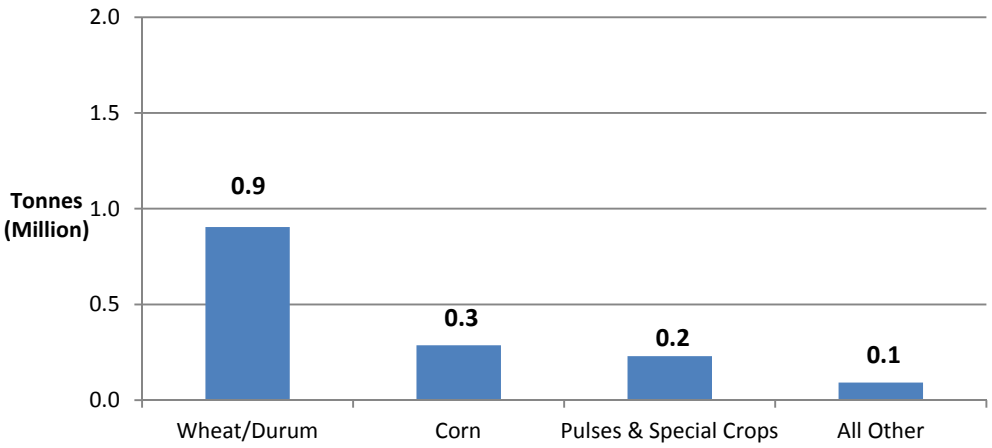
Western hemisphere countries, most notably the US, Mexico, Venezuela, Peru and Colombia, have been Canada's fastest growing export market since 1990. During this period Canadian exports to this region have grown by 11 million tonnes or 250% and now represent 15 million tonnes or 35% of total Canadian exports. The US and Mexico are the most important markets accounting for more than 70% of both current exports and growth in this region since 1990.

As can be seen in Figure 20 key growth areas include wheat and durum (40%), oilseeds (21%) and processed grains (20%). Growth in Other Grains represents a 170% increase in oats traffic (1 million tonnes) to the US.



Africa

The African continent continues to be a growth market for Canadian grain exports, particularly for wheat, pulses and corn. Since 1990 this region has maintained its share of Canadian exports at approximately 8%. Volumes have grown by more than 80% and in 2010 totaled 3.3 million tonnes.



Europe

Whereas Europe once accounted for 25% of Canadian exports - 92% of which consisted of wheat and barley - this region now represents only 10% of Canadian exports. The last twenty years has seen very different scenarios play out Eastern versus Western Europe. Eastern Europe which once accounted for 18% (5 million tonnes) of Canadian exports consisting almost exclusively of wheat and barley to the former Soviet Union has seen exports of Canadian grain products effectively disappear. Conversely Western Europe has been a growth market for Canada more than doubling imports consisting largely of soybeans and wheat.

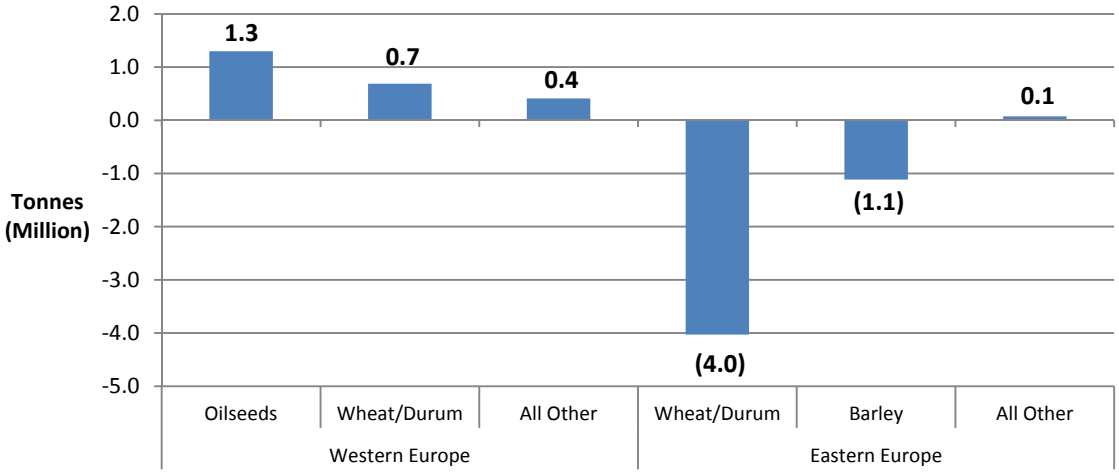


Figure 22: Change in Total Grain and Grain Products Exports to Europe – 1990 to 2010

Canada's Position in Global Production and Trade

Wheat / Durum	World	Canada
Annual Production (Million Tonnes)	645.6	24.8
Percent of Global Production		4%
Rank		6th
Countries Accounting for 90% of Production	13	
Annual Global Trade (Million Tonnes)	128.4	18.1
Percent of Global Trade		14%
Rank		3rd
Countries Accounting for 90% of Trade	14	
Percent of Production Exported	20%	73%

Barley	World	Canada
Annual Production (Million Tonnes)	139.9	9.9
Percent of Global Production		7%
Rank		4th
Countries Accounting for 90% of Production	12	
Annual Global Trade (Million Tonnes)	16.8	1.6
Percent of Global Trade		4%
Rank		5th
Countries Accounting for 90% of Trade	6	
Percent of Production Exported	12%	16%

Oilseeds	World	Canada
Annual Production (Million Tonnes)	293.3	14.8
Percent of Global Production		5%
Rank		7th
Countries Accounting for 90% of Production	7	
Annual Global Trade (Million Tonnes)	91.9	8.8
Percent of Global Trade		10%
Rank		4th
Countries Accounting for 90% of Trade	1	
Percent of Production Exported	31%	59%

Processed Grains - Oil	World	Canada
Annual Production (Million Tonnes)	113.1	2.2
Percent of Global Production		2%
Rank		11th
Countries Accounting for 90% of Production	13	
Annual Global Trade (Million Tonnes)	50.1	1.7
Percent of Global Trade		3%
Rank		6th
Countries Accounting for 90% of Trade	9	
Percent of Production Exported	44%	77%

Processed Grains - Meal	World	Canada
Annual Production (Million Tonnes)	191.5	3.7
Percent of Global Production		2%
Rank		7th
Countries Accounting for 90% of Production	8	
Annual Global Trade (Million Tonnes)	59.5	2.2
Percent of Global Trade		4%
Rank		5th
Countries Accounting for 90% of Trade	5	
Percent of Production Exported	31%	59%

Other Grains	World	Canada
Annual Production (Million Tonnes)	828.8	14.4
Percent of Global Production		2%
Rank		8th
Countries Accounting for 90% of Production	15	
Annual Global Trade (Million Tonnes)	94.3	2.7
Percent of Global Trade		3%
Rank		5th
Countries Accounting for 90% of Trade	7	
Percent of Production Exported	11%	19%

Pulses and Special Crops	World	Canada
Annual Production (Million Tonnes)	78.4	4.9
Percent of Global Production		6%
Rank		5th
Countries Accounting for 90% of Production	28	
Annual Global Trade (Million Tonnes)	13.9	3.9
Percent of Global Trade		28%
Rank		1st
Countries Accounting for 90% of Trade	21	
Percent of Production Exported	18%	80%

		Producers	Grain Company			Canadian Wheat Board	Railway	Vessel Operator		Trans-loader	Canadian Grain Commission	Buyer	
			Primary	Processor	Marketer			Bulk	Container			International	Domestic
Producers			• Contract for grain sales • Deliver grain to country facilities			• Contract grain sales	• Producer car shipper				• Order producer cars		• Contract grain sales
Grain Company	**Primary (Country & Port)**	• Contract grain purchases • Country receipt & elevation • CWB Agent			• CWB agent • Grain sales • Country and port services	• Country and port services	• Order rail cars • Demand forecasting • Load and unload railcars	• Contract ocean freight	• Book container shipments	• Purchase trans-load services	• Certifies quality, safety and weight • Develop standards for grains • Develop processes for measuring • Research on grain quality	• Sell grain	• Sell grain
	Processor	• Grain purchase • Receive producer deliveries in country			• Grain sales • Grain processing • Railcar loading services		• Order rail cars • Load railcars • Forecast demand	• Contract ocean freight	• Book container shipments	• Purchase trans-load services		• Sell grain products	
	Marketer		• Purchase grain for re-sale			• Accredited exporter • Purchase grain for re-sale	• Rail shipper	• Contract ocean freight	• Book container shipments	• Purchase trans-load services		• Accredited exporter for CWB • Sell grain products	
Canadian Wheat Board		• Grain purchase • Producer pooling	• Access country and port facilities		• Market and execute grain sales		• Order railcars • Forecast demand	• Contract ocean freight		• Purchase trans-load services	• Order producer cars	• Sell grain products	
Railway		• Receive orders, allocate and supply railcars and intermodal equipment • Local switching services at origin and destination • Railcar / container transportation from origin to destination				• Receive orders, allocate and supply hopper cars			• Freight transportation • Container storage and repositioning	• Local switching at destination • Empty container supply (depot)	• Provide data on unloads for out turn weights (for freight billing)		• Supply railcars • Local switching at origin and destination • Freight transportation
Vessel Operator	**Bulk**		• Provide ocean freight services			• Contract ocean freight					• Certify weight and grade • Issue certificate final	• Ocean freight services	
	Container		• Provide container freight services • Allocate and supply empty containers			• Contract ocean freight	• Shipper			• Supply empty containers	• Issue certificate final (pilot)	• Container freight services	
Trans-loader			• Provide trans-load services including drayage of containers to and from container terminals				• Order in railcars		• Container supply for transload		• Provide process input for standards		
Canadian Grain Commission		• Receive orders and allocate producer cars	• Facility licensing • Inspection services • Publish grain grading guidelines			• Establish standards for wheat	• Exchanges information on producer cars	• Provide Certificate Final		• Inspection services • Publish grading guidelines		• Certify quality and quantity of grain • Fee for service analytical testing	
Grainer	**International**		• Purchase grain			• Purchase grain		• Contract ocean freight			• Provide guarantee of compliance		
	Domestic		• Purchase grain			• Purchase grain	• Rail shipper						

Appendix 4: Supply Chain Relationships

Appendix 5: Grain Company Structure in Canada

The six major grain companies operating country elevators in Canada are Viterra, Richardson International, Cargill, Paterson Grain, Parrish and Heimbecker and Louis Dreyfus Canada who collectively own 75% of the network capacity. The table below provides a summary of country elevator infrastructure for the six major grain companies including the changes in ownership resulting from the recently completed acquisition of Viterra by Glencore International Plc.

Table 7: Six Major Grain Companies – Facilities and Capacity

Rank	Company	Headquarters	Facilities	Storage Capacity
1	Viterra	Regina, SK	79	1,591,130
2	Richardson International	Winnipeg, MB	73	1,389,210
3	Cargill Canada	Winnipeg, MB	32	687,260
4	Parrish and Heimbecker	Winnipeg, MB	21	405,030
5	Louis Dreyfus Canada	Calgary, AB	11	386,550
6	Paterson Grain	Winnipeg, MB	34	365,170

The largest of the six major grain companies, Calgary-headquartered Viterra was formed in 2009 from a merger of the assets of Agricore United and the Saskatchewan Wheat Pool. In the spring of 2012, in a friendly takeover bid, Glencore International Plc of Switzerland made an offer to purchase Viterra, including its assets in the US, Australia, China and the Ukraine. After government approvals in all five countries were complete, the purchase was consummated in early December 2012.

Relative to the Canadian portion of Viterra, as part of the takeover bid, Glencore entered into an agreement with Agrium Inc. (Agrium) and Richardson International Limited (Richardson International) for the sale of specific Viterra assets. Under these agreements, Agrium was to acquire approximately 90% of Viterra's Canadian retail crop input facilities, and its minority position in Canadian Fertilizer Limited's nitrogen production facility in Medicine Hat, Alberta. Similarly, Richardson International was to acquire 23% of Viterra's Canadian grain handling assets, including 19 grain elevators and the crop input centers co-located with those elevators, a 25% ownership interest in Vancouver's Cascadia Terminal, a Viterra export terminal in Thunder Bay, along with its Can-Oat Milling and 21st Century grain processing subsidiaries. The takeover and attendant asset sales leaves Viterra with 79 country facilities, 2 port facilities in Vancouver (75% interest in Cascadia terminal and 100% of Pacific), 1 port facility at each of the ports of Thunder Bay and Montreal and a share in the Port of Prince Rupert facility.

Richardson International ranks second among the majors and the Viterra agreement only goes to enhance their position in the Canadian marketplace, with 73 country elevators. In addition to its grain gathering operations and the asset gained in the Viterra transaction, the company has significant investments in canola crushing plants

located in Yorkton, SK and Lethbridge, AB. Richardson also has global reach with merchandising offices around the world.

US conglomerate Cargill is the third largest company. The company operates a diversified agri-food business in Canada and also owns and operates canola crushing operations at Clavet, SK.

Louis Dreyfus, Paterson Grain and Parrish and Heimbecker have agricultural interests beyond their country elevator operations: Paterson Grain has interests in wheat milling operations in Saskatchewan and the US and Parish and Heimbecker operates a Vancouver grain transloading facility and a significant grain warehousing and ship loading operation at the Fraser Surrey docks in Delta, BC. Louis Dreyfus operates a recently constructed large canola crushing plant at Yorkton, SK.

Independent Terminals

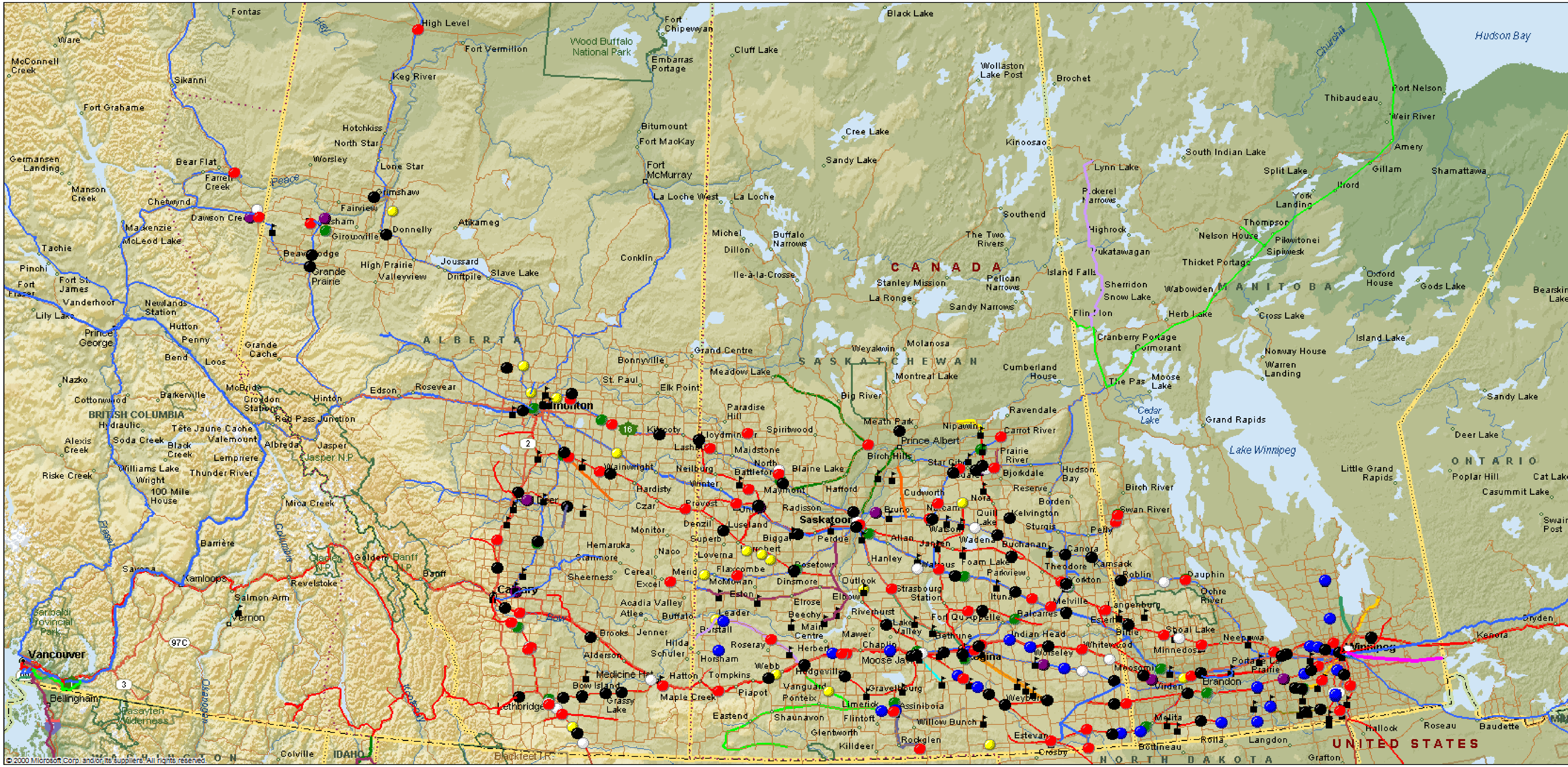
The 23 independently owned elevators (some of whom are members of the Independent Terminal Association of Canada represent 9% of network capacity with the remainder held by a variety of grain dealers, processors and special crop handlers. Independent terminals evolved in the late 1970's in response to producer dissatisfaction with the major grain pools and grain companies. Weyburn Inland Terminal, now the largest of the group, was the first to enter the market in 1976 and their success resulted in a number of initiatives across the Prairies as more producer groups formed and constructed large scale high throughput concrete facilities. Many were built as a means for producers to have some control of the pending rationalization they saw coming to the network in the 1990's. Some independent terminal operators have established relationships with major grain companies for varying combinations of operational, marketing or equity purposes. A degree of industry rationalization has taken place that has seen some independent operators purchased or taken over by major grain companies although most remain in business.

Other Processors and Facility operators

The remaining 121 CGC licensed facilities in Western Canada are operated by a variety of processors or grain dealers. These operations represent 31% of facilities and 17% of country facility storage capacity in Western Canada. Their businesses are diversified including barley malting, ethanol production, canola crushing and specialty seed and pulse processing. Canada Malt, the largest of the maltsters in Canada, operates eleven sourcing and production facilities. Legumex Walker with nine facilities and Alliance Pulse Processors with eight facilities located in Manitoba, Saskatchewan and Alberta are the largest pulse processing operators in Canada. In addition, both companies have facilities located in the US.

Appendix 6: Western Canadian Country Elevator Network

Cargill
Pioneer/ JRI
Viterra
Paterson
P & H
LDC
ITAC
Other Processors and Dealers
CN
CP



Appendix 7: Western Canadian Prairie Rail

Appendix 8: Western Canadian Rail and Port Network

Appendix 9: Thunder Bay and Eastern Canadian Rail and Port Network