The Containerization of Commodities: Integrating Inland Ports with Gateways and Corridors in Western Canada

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Executive Summary

This report provides an analysis of the major trends in the containerization of commodities and looks at its commercial potential and operational hurdles. The setting of inland ports in Western Canada is seen as a strategy to help reconcile import (retail dominated) and export (commodities dominated) logistics.

The containerization of commodities involves the development and expansion of a niche market that can fluctuate according to the price of the respective commodities, the nature and extent of the demand and container shipping rates. All of these are commodity specific and will convey new opportunities for commodity exporters and buyers alike. The last decade have been prone to the containerization of commodities as container shipping rates remained relatively constant while the price of most commodity groups doubled or tripled. Containerization enables a better level of inventory management of commodities. Yet, the availability of containers is a recurring challenge since maritime shipping companies, as dominant managers of containerized assets, will allocate them where there are commercial opportunities to recoup the costs of having these containers circulating outside their shipping and port networks.

A growing level of intermodal integration is being observed in Western Canada, which reflects a trend observed across North America and elsewhere around the world. Inland ports are likely to be the missing multiplying effect that would encourage maritime shipping companies to have a larger number of containerized assets moving inland. It is still too early to assess the extent inland ports will play in the containerization of commodities, but it has grown rapidly. Yet, transloading near port terminal facilities has been a preferred strategy to cope with the challenges in the availability of containers. There are indications that some transloading activities can be effectively moved inland, particularly in Calgary and Edmonton where there is a good supply of domestic containers available.

Western Canadian containerized commodity exports concern a very specific range of commodities with wood products (lumber and wood pulp) and specialty grains (canola and lentils) accounting for a dominant share of the volume. This range is expected to increase, mainly because containerization supports product and market diversification and load integrity. The growth potential is impaired by an array of operational hurdles where many maritime shipping companies see rather limited advantages of having their containerized assets spending undue time in the hinterland.
Acknowledgments

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A. Background and Scope

Containerization has been a driving force behind globalization and is dominantly associated with the movements of commercial goods such as parts and retail goods. It began by replacing the conventional system of handling break-bulk cargo in general cargo vessels or passenger vessels that handled express type shipments. These goods when handled individually were subject to a great deal of loss and damage (Long shoring was a synonym for organized crime in the fifties). The first step was to containerize the most valuable cargos such as high end consumer goods that were prone to theft and subject to damage when handled. Ultimately, almost all consumer goods were containerized followed by most manufactured goods, such as parts. More recently, a growing quantity of commodities such as specialty grain and wood products are being shipped in containers. Among the factors that lead to the usage of containers to ship commodities are trade imbalances providing a pool of empty containers for backhaul movements, the rising long term price of commodities making containerization an increasingly cost effective proposition, and intermodal transport systems that have extended market coverage. Containers can be shipped to a wide variety of destinations in foreign markets, from a single unit to large stacks.

Western Canada being a region rich in resources is particularly impacted by the opportunities the container offers for commodity exports, with Asia Pacific markets being the main driver. Additionally, the growing demand for refrigerated goods around the world, such as meat, fruits and vegetables, has created an active refrigerated containers (reefers) trade which concerns specialized and high value supply chains.

The Asia-Pacific Gateway and Corridor initiative that was put forward in 2006 focuses on strengthening an existing axis of continental freight distribution between the Canadian West Coast (Vancouver and the new container Port of Prince Rupert) and North America's heartland (such as Chicago and Toronto). The Gateway and Corridor initiative involved over $1 billion of federal investments in various modal projects, with rail / road grade separation projects at key locations, particularly in the Vancouver metropolitan area. The Government of Canada, in partnership with, the Government of British Columbia, local governments, and private sector partners, has committed to invest an additional $22 billion to projects that support the Pacific Gateway. A better level of connectivity and accessibility to foreign markets set a more favourable context to promote hinterland intermodal and logistics initiatives.

In the last decade, several inland port projects have been developed in Western Canada around intermodal rail terminals. The surge in transpacific trade has created an inland volume large enough to encourage the organization and rationalization of inland freight

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distribution. Inland ports are a response to this process as they encourage economies of scale and logistical efficiency through the principle of co-location\(^2\). The prevailing view about inland ports is related to their role as platforms supporting inbound / import logistics as sufficient volumes are being generated to support their operations. This role as an export platform is also expanding, which is of fundamental importance considering the prevalence of commodities such as lumber and specialty grains in Western Canada. While bulk remains the most efficient way to move ponderous cargo, containerization offers opportunities for niche players, particularly if they do not generate enough volumes to use bulk trains. Yet, the containerization of commodities is prone to challenges as it concerns completely different logistical systems than the prevailing inbound retail trade.

The purpose of this report is to provide a perspective on the containerization of commodities in Western Canada and how inland ports can act as strategic platforms helping reconciling inbound and outbound logistics. The two major challenges remain the willingness of maritime shipping and container leasing companies to have ISO containers\(^3\) positioned at inland facilities as well as the level of intermodal rail services (frequency and capacity) to these inland locations. In recent years, the development of inland ports under a formal governance structure such as Global Transportation Hub in Regina and CentrePort Canada in Winnipeg underline that this value proposition is increasingly attractive.

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\(^2\) The setting of distribution centers in proximity or adjacent to the intermodal rail terminal.

\(^3\) ISO (International Standards Organization) containers refer to maritime containers of specific dimensions that can be handled by any standard intermodal equipment such as a container ships, port cranes, rail cars, trucks (etc.).
B. The Setting of Western Canada’s Inland Port System

The North American System of Gateways and Corridors

The North American economy can be considered as an integrated system of global and regional supply chains structured by corridors linking production centres and distribution hubs across the continent. These supply chains depend on efficient infrastructures as well as coherent and consistent supply chains. About a third of trade with the United States took place within the framework of North American Free Trade Agreement (NAFTA), mainly through land gateways that are effectively ports of entry into the United States. More than anywhere else in the world, North American commerce is not just about trade, but about functionally integrated supply chains.

Like many segments of the North American economy, globalization and integration processes have impacted on the nature and function of continental production, consumption and distribution. Freight distribution is coordinated by major gateways (container ports) and inland load centers (ILC) that emerged in the recent decades to help handle growing hinterland trade volumes (Figure 1). The term “inland port” has three fundamental characteristics:

- An intermodal terminal, either rail or barge that has been built or expanded.
- A connection with a port terminal through rail, barge or truck services, often through a high capacity corridor. In North America, barge intermodal services are highly marginal, but may show some potential for specific coastal segments.
- An array of logistical activities that support and organize the freight transited, often co-located with the intermodal terminal.

The functional specialization of inland ports is characterized by the clustering of logistics sites in a given area. They have become excellent locations for consolidating a range of ancillary activities and logistics companies. In recent years, the dynamics in logistics networks have created the right conditions for a large-scale development of such logistics zones and therefore of inland ports.

The extent of the market area of an ILC is related to the supply chains being serviced. Each supply chain has different requirements in terms of lead time as well as the volume and frequency of deliveries. Many supply chains, particularly in retail, rely on daily

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deliveries, implying that the market area is mainly a function of the average length of a domestic truck freight haul, which is around 500 miles (800 km). Thus, 500 miles is considered to be the upper limit of an operational daily radius for trucking, although shorter distances are generally preferred. 500 miles acts as a proxy for travel time, but a day of trucking can vary depending on the congestion level, which also has an impact on the reliability of deliveries. Additionally, new safety regulations for trucking are being implemented in the United States since 2008 (CSA; Compliance Safety Accountability) and which will impose more stringent monitoring of driving hours. The likely outcome is a reduction in the average length of domestic truck hauls.

In Figure 1 below, in Canada, the two most important container ports stand at two extremes; Montreal covers 23% of the American population within 500 miles while Vancouver covers only 4%. Their respective hinterlands thus differ significantly as the West Coast relies on long distance rail corridors while drayage\(^6\) is more dominant for the East Coast.

With specific reference to the United States, Figure 1 also depicts the share of the total American population within a 500 miles radius from each major inland load centre. This share depicts the approximate market size (e.g. retail demand) within a daily truck trip. From this standpoint, the optimal location is in the vicinity of Columbus, Ohio with 47% of the US population accessible within a day of trucking. Most locations within the Midwest have a share above 35%.

\(^6\) Generally refers to truck transportation between a terminal and the customer.
Since a significant share of retail goods are imported through container ports, it is important to also consider port throughput as a factor in combination with market accessibility. It underlines the difference between regionally anchored and long distance logistic functions. For Los Angeles / Long Beach, only 15% of the US population is within 500 miles while for New York this share is double (30%). Thus, a great share of the logistical activities performed at LA/LB concern long distance freight distribution along the Los Angeles / Kansas City / Chicago rail corridor (landbridge) as the regional market is not large enough to support such a volume. This involves for instance an active transloading function where the contents of maritime containers are transloaded into domestic containers. For New York, more than 80% of all the traffic is bound to the immediate hinterland, implying that transloading is less prominent since most maritime containers will be brought directly to the customers.

The Western Canadian System

Within the North American system of freight distribution, Western Canada plays a unique role as a point of transit between the Pacific gateways and major markets of the
heartland of North American and as a commodity exporter of wood, food and energy products that readily finds demand in North American and global markets. A study commissioned by Transport Canada in 2008 underlined that there were opportunities for the containerization of Western Canadian commodities and that inland ports could improve the competitiveness of these exports, particularly at smaller locations such as Prince George, Saskatoon and Regina. For such locations, an inland port enables the setting of a critical mass of freight volumes that lower intermodal transport costs and improve the efficiency of drayage.

One of the main advantages of investigating the containerization of commodities in the Western Canadian context is that there are essentially two gateways, Vancouver and Prince Rupert. Figure 2 indicates the relative traffic volumes served by each port. To date Vancouver’s volumes are significantly higher with Prince Rupert growing at a significant rate. In such a context, analyzing the traffic handled by both ports provides an accurate picture of the Western Canadian containerized commercial system in terms of the main commodities handled.

![Figure 2 - Trade Corridors and Inland Load Centres, Western Canada](image)

Figure 2 summarizes the Western Canadian system of freight circulation, which is composed of the following elements:

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7 Hanam Canada Corporation (2008) Pacific Coast Container Terminal Competitiveness Study, TP 14837E.
• Ports acting as gateways to international trade. The Puget Sound cluster (Seattle, Tacoma and Vancouver) is the most significant array of port terminals in the Pacific Northwest. Ports are also terminal clusters, particularly large ports where terminal operators may be competing. Port centric logistics activities are playing an important role in the organization of containerized flows, particularly with the functions transloading and stuffing that are actively used along West Coast ports. Phase 1 development of the Fairview Container Terminal at Prince Rupert, which opened in 2007, had an initial design capacity of 750,000 TEU. New terminal and rail investments will improve this capacity to 1.2 million TEU by 2014. The phase 2 expansion adds an additional 800,000 TEU capacity; this expansion is expected to be completed by 2020.

• Trade corridors are the main axis of rail and truck circulation. Due to low population densities and the long distance involved, the share of rail for inbound containers is high; Vancouver (68% of import containers), Seattle / Tacoma (67%), Los Angeles / Long Beach (around 50%). For Western Canada, two lateral corridors with two railways servicing them are the main means to access the hinterland. The northern corridor (Vancouver / Prince Rupert – Edmonton – Saskatoon – Winnipeg) is dominantly serviced by CN while the southern corridor (Vancouver – Calgary – Regina – Winnipeg) is dominantly serviced by CP. One particular advantage of the northern corridor concerns its lower gradient and congestion level. These long distance corridors are supporting economies of scale (e.g. doublestacking) that help reconcile growing port traffic and effective hinterland access.

• Inland load centres are the main intermodal rail facilities and commercial hubs. In Figure 2, inland load centres are categorized in two levels of importance related to their demographic size. In the Western Canadian context, each provides access to wide market, but with limited density from a consumption perspective. The setting of inland ports is a strategy to increase the scale and scope of intermodal accessibility inland.

• Cross-border traffic is an indication of economic interactions and interdependency between Canada and the United States. Although the Asia-Pacific Gateway and Corridor initiative tends to focus on longitudinal flows, there are expectations that latitudinal flows will provide an additional commercial potential to inland load centres.
C. Drivers behind the Containerized Commodity Trade

The containerization of commodities has been a growing trend in global shipping markets. The degree of market penetration of containerization remains to be assessed and there is a wide variety of levels into which the container can be embedded within various commodity chains. Some commodities, like coffee and bananas, are already fully containerized, while for others, such as lumber and specialty grain, containerization is still in its early stages with its real potential depending on a number of drivers.

Economies of Scale in Maritime Shipping

The principle of economies of scale is well understood in maritime shipping since larger ships have led to lower cost per unit transported. However, the application of economies of scale in bulk shipping and in containerized shipping result in very different commercial outcomes since through economies of scale containerized shipping retains its atomization (the individual container remains the minimum load unit). In bulk, economies of scale increase the minimum load unit proportionally. General cargo vessels used to handle a wide range of cargoes such as packaged goods in one hold and bulk in another hold. In the current context the only option for bulk cargoes is specifically designed bulk ships. Typically, these bulk vessels are quite large with the minimum size in typical overseas service being the Handy Class (20,000 to 40,000 dwt). These bulk vessels are typically used for full loads. As a result, shipments of bulk commodities in less than full vessel loads are facing the challenge of vessel availability. This in turn creates the niche market for containerization of certain bulk commodities.

A growing number and availability of containers in transport markets around the world are making them a rather ubiquitous transport product. The market accessibility supported by containerization is conducive to transactions between new actors, either as suppliers or customers. Yet, this ubiquity is challenged by shortages of containers and shortages of specific container sizes in some markets. For instance, there is a problem of maritime container availability at inland ports in Western Canada. This problem compounded by a shortage of 20 foot containers that are more economically and structurally suited for commodity exports. Empty container repositioning has created opportunities by making available pools of empty containers that can be filled for backhauls flows.

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8 Shipping commodities tends to rely on 20 foot containers (20 footers; one TEU) for the simple reason that they can each load around 26 to 28 tons while a 40 foot container (40 footer; 2 TEU), because of structural integrity issues, has a loading capacity of about 30 tons, but this load is occupying twice the shipping volume.
Commodities represent a niche market where there is additional growth potential that shippers will be increasingly attracted to accommodate. There are also indications that the process of containerization, particularly the segment related to retail goods, has more limited growth prospects. This is mostly due to demand saturation in developed economies such as North America and Western Europe. It relates to demographic characteristics such as expected growth levels, but also to the aging of the population. Both trends are indicative of less growth potential for retail and its associated container flows.

**Rise in Commodity Prices and Demand**

A general rise in commodity prices and growing demand in new markets have made many commodities more prone to be containerized from a value proposition standpoint. For instance, the evolution of the CRB index\(^9\) is indicative of an environment where commodities are at an aggregate level more expensive (Figure 3). The higher the price of a commodity, the more suitable it is for containerization. At an aggregate level, the price of commodities stands in 2011 around three to four times higher than in 2000. It is important to note that several commodities tracked by the CRB index are not produced in Western Canada, such as sugar, cacao and coffee. Still, 79% of the components of the CRB are commodities produced in Western Canada.

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\(^9\) The CRB is a composite index (also known as the Continuous Commodity Index; CCI) of 19 commodity futures prices, including Aluminum (6%), Cocoa (5%), Coffee (5%), Copper (6%), Corn (6%), Cotton (5%), Crude oil (23%), Gold (6%), Heating oil (5%), Lean Hogs (1%), Live cattle (6%), Natural Gas (6%), Nickel (1%), Orange juice (1%), Silver (1%), Soy beans (6%), Sugar (5%), Unleaded Gas (5%), and Wheat (1%).
The container confers few differences in scale economies for a producer (exporter) as each container is a unique transport unit and containerized shipping networks are fairly ubiquitous. Barriers to entry are thus quite small as each container is an independent load unit that can accommodate lower volumes without much drawbacks as long as other containerized volumes are present; economies of scale are very important for terminal operators and maritime shipping. For instance, agricultural producers may develop their own markets by sending small agricultural commodity loads through regular containerized supply chains. Thus, containerization can provide the double benefit of permitting the development of global niche markets where numerous small exporters may compete, as well as offering new economic development venues in commodity sectors which could not previously access foreign markets. Containerization potential remain commodity specific since low prices for a commodity, such as waste paper, command much less of a premium than commodities such as lumber or specialty grain.

Figure 3 - CRB Index (CCI), Monthly Close, 1970-2011

10 Source: Commodity Research Bureau.
Bulk and Container Shipping Rates

While bulk shipping remains the most cost effective option to move large quantities of bulk cargo, fluctuations and rises in bulk shipping rates have caused the search, when feasible, of alternatives for niche markets. Volatility also makes long term planning for bulk shipping complex and subject to risks. In recent years, the BDI\textsuperscript{12} has experienced much volatility and has climbed much faster than the CRB, which implies that in relative terms the cost of shipping bulk commodities has grown faster than for commodities (Figure 4). A major reason for the rise in bulk shipping rates is the rise in bunker fuel prices as well as a higher demand for this commodity. There is thus a comparative cost incentive to consider containerization as an alternative to ship bulk commodities under specific conditions that are particularly related to the price of commodities and the comparative costs of bulk versus containerized shipping. The collapse of the BDI and the CRB in late 2008 and early 2009 has placed bulk shipping rates more in line with the conventional relation with commodity prices. It remains to be seen how this relationship will unfold and if this represents new market conditions that would impact the growth containerized commodities have experienced in recent years.

Figure 4 - Continuous Commodity Index and Baltic Dry Index, 2000-2011 (2000=100)\textsuperscript{13}

\begin{center}
\includegraphics[width=\textwidth]{figure4.png}
\end{center}

\textsuperscript{12} The Baltic Dry Index (BDI) is an assessment of the average price to ship raw materials (such as coal, iron ore, cement and grains) on a number of shipping routes and by ship size. It is thus an indicator of the cost paid to ship raw materials on global markets and an important component of input costs.

\textsuperscript{13} Source: Bloomberg.
Between the mid-1990s and the early 2000s, container shipping rates have on average been declining as economies of scale were applied in maritime shipping (lower cost per TEU\textsuperscript{14} carried). During the same period, i.e. 1995 – 2000, the Continuous Commodity Index (CCI) followed the same downward trend as container shipping rates (Figure 5). While the CCI surged after 2002, the average container shipping rate continued its overall decline (inflation adjusted). From a cargo value / transport cost per TEU proposition, the containerized shipping of commodities has become more advantageous, and this even after the sharp correction that took place in late 2008 due to the unfolding financial crisis. This correction also had a deflationary impact on container shipping rates, so the spread between the evolution of the price of commodities and container shipping rates remains significant and is expected to remain as such. Relatively stable and even declining container shipping costs (inflation adjusted), particularly in light of rising commodity prices, render the container even more attractive since shippers can be confident about the relative long term stability of container shipping rates.

\textbf{Figure 5 - Continuous Commodity Index and Average Container Shipping Rates, 1994-2011 (1994=100)}\textsuperscript{15}

\textsuperscript{14} Twenty foot Equivalent Unit.
\textsuperscript{15} The container shipping rate is an un-weighted average of shipping rates per TEU along four major long distance shipping routes (Asia - United States and Asia - Europe).
Figure 5 also suggests that a significant containerization of commodities could increase the volatility of container shipping rates along routes that are commodity intensive. However, there is limited evidence to support this assertion. Global trade imbalances are transcribed in imbalanced container shipping rates; the inbound rates for the net importer are higher than the outbound rates for the net exporter. Depending on the scale of the trade imbalance, this can represent a notable export subsidy for return (backhaul) cargo. For markets having significant imbalances, such as China (exports) and the United States (imports), incentives are acute to ship commodities on the backhaul since the transport rate is much lower (see Figure 6).

Table 1 summarizes the main drivers discussed so far that are making the containerization of commodities a more attractive value proposition at the global level. However, container availability, rate, and imbalance vary for each location in Western Canada.

Table 1 - Main Macroeconomic Drivers in the Containerization of Commodities

<table>
<thead>
<tr>
<th>Factor</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economies of scale in maritime shipping</td>
<td>Growing minimum load unit for bulk. More containers available on freight markets. Ubiquitous transport product.</td>
</tr>
<tr>
<td>Rising demand and commodity prices</td>
<td>More commodities in circulation (usage of containerization to accommodate growth). New producers and consumers (marginal markets penetration).</td>
</tr>
<tr>
<td>Fluctuations in bulk shipping rates</td>
<td>Decrease in the ratio cargo value per ton shipping rate for commodities. Volatility (rates) and risk (hedging). Search for options to bulk shipping.</td>
</tr>
<tr>
<td>Low container shipping rates</td>
<td>Increase in the ratio cargo value per TEU shipping rate for commodities. Relative rate stability. Containerization more attractive as an option.</td>
</tr>
<tr>
<td>Imbalances in container shipping rates</td>
<td>Export subsidy for return cargo. Pools of containers available for backhauls.</td>
</tr>
</tbody>
</table>

The business case for the containerization of commodities has improved and opportunities exist for the trend to continue. For several commodity groups, containerization is a suitable alternative to bulk shipping, particularly in the context where the integrity of a load can be maintained across a supply chain and where transactions involve relatively small volumes. Yet, the risk remains of a significant and
enduring drop in commodity prices as well as a drop of Asian demand. The most likely scenario is that commodity prices will remain higher than the early 2000s reference line and that Asian demand, particularly for food, will continue.
D. Maritime Shipping Companies and Containerized Assets

Maritime shipping companies are a significant driver with influence over supply chains and the availability of containers. Even if maritime shipping lines are perceived to be those who have the most influence in the allocation of container assets, they essentially service beneficial cargo owners and will cater to the needs of their customers. Therefore, this influence remains bound to market forces of supply and demand. As of 2009, maritime shipping companies owned approximately 62% of the global ISO container fleet, making them the dominant players in the container leasing sector. Containers are an asset that maritime shipping companies make available as a service to their customers to help retain the cargo flows within the shipper’s network, generating revenues for the shipping line, the terminal operator, the container and chassis leasing branches, and affiliated warehouses, trucking and rail operators. From a carrier’s perspective, providing containers is therefore a tool to help leverage their containerships and related assets. The more effectively this asset is used, namely in terms of the number of paying trips per year, the more the revenue. Still, for a maritime shipping company, managing containerized assets implies several challenges.

Imbalanced Container Flows and Maritime Freight Rates

Imbalanced trade flows are resulting in imbalanced container flows. Repositioning empty containers utilizes about 20% of the global fleet capacity. This is wasteful and dictates that shipping lines manage closely their containerized assets so that the most profitable trades receive priority in the allocation of containers. The demand from Asian focused trades commonly receives priority in the allocation of containers, since this tends to generate the most revenues. The peak season periods, roughly between July and October, are the most challenging for shipping companies to provide an adequate supply of empty container equipment to be made available for the higher revenue Asian exports to Europe, North America as well intra-Asia trade requirements.

Imbalances impose different freight rates for inbound and outbound flows, with inbound rates subsidizing outbound rates, including the repositioning costs of empties. It could even been argued that because of imbalances shipping lines have an oversupply of containers in the hinterland since there are empty backhauls (supply / demand mismatch). Under such circumstances, shipping companies try to maximize the usage of inbound paying flows, leading to repositioning of empty containers back across the pacific as fast as possible so that they can get paying cargo. Transloading improves container utilization by 21 to 28 days on a transpacific shipping loop, improving the level
of asset utilization and earnings\textsuperscript{16}. For instance, on a typical transpacific trip to Vancouver, about eight trips for the same container are possible per year if the container only stays at the port. If the container goes inland, then the number of yearly trips drops to about six. This strategy is visible at the Port Metro Vancouver and the Port of Prince Rupert where in 2010 respectively 10.9\% and 25.3\% of the container traffic was composed of exported empty containers.

The cost structure of the transport chain will be an important determinant in the comparative advantages of respective routing options across North America, including the landbridge, the usage of the Suez Canal, or the all-water route through the Panama Canal (Figure 6). For transpacific trade, the pattern for inbound traffic is straightforward and a function of shipping distance; the lowest among the sample being Vancouver and the highest being Montreal at the opposite end of the all-water route (compounded by a significant detour through the St. Lawrence).

The container shipping rates for outbound traffic differ with shipping distance playing a much less evident role. They are more reflective of trade patterns, particularly of export opportunities in the port’s hinterland. Where inbound flows are significant and where return cargo is proportionally scarcer, outbound rates are much lower as shipping companies try to attract backhaul cargo by discounting. The greatest paradox concerns

17 Source: Drewry Container Benchmarks. Note: The rate benchmarks are for full container loads and include the base ocean rate, the terminal handling charge both at origin and at destination, the fuel surcharge and all other surcharges; they do not include inland transport costs. Source for equivalence lines: WorleyParsons and Princeton Consultants, Inc.
New York and Vancouver, both at the opposite end of the all-water route from Asia. While, as expected, the inbound rate per TEU was 60% higher for New York than Vancouver in 2010, the outbound rate was 15% cheaper for New York. Container shipping rates tend to fluctuate with market changes (e.g. changes in the export composition or in the number of ship calls). For instance, the outbound rates for Los Angeles and Vancouver have narrowed down significantly. The availability of empty containers along the East Coast, as exemplified by New York, could expand export opportunities with the Panama Canal expansion in 2014\textsuperscript{18} since the cost equivalence line\textsuperscript{19} is expected to go further inland.

It is uncertain to what extent the expansion of the Panama Canal will have an impact over the availability of containers inland in Western Canada. If a greater share of containerized trade uses East Coast ports instead of the landbridge this may also provide a pool of empty containers inland, but would require domestic repositioning and use agreements with railways. It is expected that Chicago would be within the cost equivalence line. If this is the case, CN and CP, who both have intermodal terminals in Chicago, could have access to a more extended pool of maritime containers for domestic repositioning and exports.

**Inland Freight Rates**

The inland transport cost structure is also of importance for the availability of maritime containers at inland ports. The cost differences per TEU/km between maritime and inland transportation remain significant, implying a much greater resistance for inland intermodal movements. While it costs about $2,300 to bring a 40 foot container from Shanghai to Vancouver (about 11,000 km), carrying this container from Vancouver to Toronto (about 3,300 km) incurs a cost in the range of $1,500. This involves $0.21 per FEU\textsuperscript{20}/km for the maritime segment and $0.45 per FEU/km for the rail segment. Then, repositioning this container empty from Toronto to Vancouver costs about $800. There are thus incentives to adopt strategies trying to minimize inland transportation costs, with transloading being an attractive option.

To these basic cost comparisons, there are additional impediments to delivering maritime containers at an inland location. One concerns the equipment costs. The preference for exporters to have equipment (container and chassis) pools in the vicinity is an expensive proposition for carriers. In addition to involving some repositioning

\textsuperscript{18} For a detailed discussion about the potential impacts of the Panama Canal expansion on North American supply chains see: Rodrigue, J-P (2010) Factors Impacting North American Freight Distribution in View of the Panama Canal Expansion, The Van Horne Institute, University of Calgary.

\textsuperscript{19} The cost equivalence line is a boundary around which inland container transportation costs from the West Coast and East Coast are similar. Thus, strictly from a transport cost perspective, importers and exporters can be indifferent in either using an East Coast or West Coast port.

\textsuperscript{20} Forty Foot Equivalent Unit.
delays between the location of unloading and the location where the container can be used to carry an export load. Additionally, when a container is made available at an inland location to be loaded for exports, it might not be used immediately as the export load may not yet be available. This is common for commodities. Another issue concerns storage costs for the time the container is waiting for backhaul cargo. For an intermodal rail terminal, the free dwell time is often 48 hours or less, after which storage charges either within the terminal or outside (if the container is repositioned to off-yard storage facility) are incurred. Comparatively, the free dwell time at a maritime terminal can be five days. Therefore, the longer the delay in finding backhaul cargo, the higher the storage charges, in addition of having the container during that time sitting idle and not generating income for the shipping line or the leasing company.

As many commodity shipments, particularly specialty grain, require a thoroughly cleaned container, this task incurs additional charges, which adds to the cost of shipping. Regular container cargo loads, such as boxed goods, require a basic level of container cleanliness which commonly does not require any additional preparation if the export load is of similar nature than the import load. Looking at all these costs and impediments, the margins in shipping commodities in maritime containers from inland locations are at best tight. For many carriers, the inland transport cost is often based on a break-even (cost recovery) strategy, implying that they do not actively seek profitability for the inland leg. Unless the net revenue covers the repositioning costs and the expected revenue per box target set by shipping line policy, making containers available to any location is not a priority for the ocean carrier.

**Location and Load Availability**

Location and load unit availability concerns the double challenge of having container assets at the right location and with the right load unit. There is a location and load mismatch between inbound and outbound container flows in North America. The preferred inbound unit is the high cube forty foot container, while the preferred unit for exporting commodities is the 20 foot standard container. These mismatches are impossible to reconcile in a cost effective manner and lead to challenges in the availability of containers for exports, particularly inland. There is a very high demand for 20 foot containers in the Prairies that is difficult to fulfill, notably during the peak commodity export season (September to December). It is also worth underlining that container assets are managed by shipping lines from a system-wide perspective; the shipping line’s global network. Therefore, even if regional managers would be willing to allocate additional containers at inland locations, this may be at odds with the general strategy of the shipping line and such decisions would be overridden.

Since maritime shipping companies are focused on port-to-port services (which is their core business), the default preference is to avoid having containers move into the hinterland, and this especially over long distances (more than a day of drayage). Some
shipping lines have a formal business plan of not moving containers inland. For basic market servicing considerations, carriers will allow maritime container movements to inland locations in Western and Eastern Canada, but this repositioning commonly takes place from the main inbound locations, which are Toronto and Montreal. This obviously involves long repositioning distances (and thus high repositioning costs) to insure that containers unloading at import locations are made available where exports can be loaded. Over this issue, shipping companies that are servicing both the Canadian West and East coasts have the option of repositioning containers in a more cost effective way (e.g. a container bound to Toronto through Vancouver can be exported through Montreal or Halifax).

The fact remains that within the maritime system containers generate income for the carriers as opposed to the hinterland where they generate income for truck and rail companies. Maritime shippers are also dependent on the capacity of railways to reposition containerized assets, which can be problematic during peak season. Railways have also their domestic markets, so there is often a level of divergence between the priorities of railways and those of maritime shippers. To cope with this operational challenge, maritime shipping companies have set domestic use programs with CN and CP where the railways are able to use a maritime container for one or two domestic repositioning as long as the containers are brought to a pre-designed location in usable condition (cleaned). This accounts for about half of the containers brought inland. The main advantage for the shipping line is that under this program it does not need to pay repositioning costs (e.g. $800 from Toronto to Vancouver) while the railway gets a container that it can use for carrying paying cargo on domestic routes.

**Commodity Price Volatility**

Import contracts typically have stable prices and are often negotiated on an annual basis, while export contracts are more subject to volatile prices and are negotiated monthly. For instance, the price of retail goods will not fluctuate significantly on an annual basis, so input costs considerations are a known entity and are a rather marginal concern within this time frame. Retail goods are associated with stable import flows with seasonal variations such as the peak fall retail season. Inversely, the price of specialty crops can change several times during the growing and harvest season, as commodity futures market are quite volatile and seasonal. Therefore, in light of this volatility, shipping companies are reluctant to assign containerized assets on a long term. It involves the risk of a sudden drop in shipping demand if the price of commodities drops below a certain threshold level. Under such circumstances exporters are switching to bulk where bulk volumes warrant.

Yet, seasonality may also play to the advantage of the containerization of commodities related to food products. The peak commercial season in North America (July to October) corresponds to the harvest of food commodities. Therefore, greater quantities
of containers are available inland as backhaul opportunities arise in the late summer and early fall. Yet, this opportunity is difficult to capture since shipping companies require their containers to be quickly repositioned across the Pacific as inbound traffic concerns high value cargo.

**Container Weight**

Weight issues are challenging as containerships are designed to handle a specific weight load and distribution. 10 to 14 tons per loaded TEU are common in operational considerations when allocating containers on a containership. At most West Coast ports an import container weighs on average nine tons while an export container weighs 24 tons, implying significant weight differences between typical retail and commodities container loads. Table 2 illustrates the weight of a fully loaded 20 foot container of selected commodities. Some commodities such as coal and paper are too heavy to fill a full 20 foot container, which is restricted to a weight of about 26 to 28 tons permitted by carriers. The majority of grains have a density that enables the near utilization of a full 20 foot container while being under the maximum weight restriction. For instance, a 20 foot container fully loaded with wheat would weight about 28 tons, just two tons above the port limit of 26 tons.

**Table 2 - Containerized Weight for Selected Commodities**

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Pounds per cubic foot</th>
<th>Weight in a fully loaded 20 foot container</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>48</td>
<td>26 tons* (28 tons)</td>
</tr>
<tr>
<td>Corn</td>
<td>45</td>
<td>26 tons</td>
</tr>
<tr>
<td>Dry peas, beans and lentils</td>
<td>37</td>
<td>22 tons</td>
</tr>
<tr>
<td>Vegetable oil (e.g. canola)</td>
<td>60</td>
<td>26 tons* (35 tons)</td>
</tr>
<tr>
<td>Coffee (fresh beans)</td>
<td>35</td>
<td>21 tons</td>
</tr>
<tr>
<td>Lumber (2x4s)</td>
<td>45</td>
<td>26 tons</td>
</tr>
<tr>
<td>Hay (e.g. alfalfa)</td>
<td>14</td>
<td>8 tons</td>
</tr>
<tr>
<td>Potash</td>
<td>80</td>
<td>26 tons* (46 tons)</td>
</tr>
<tr>
<td>Coal (Anthracite)</td>
<td>70</td>
<td>26 tons* (41 tons)</td>
</tr>
<tr>
<td>Paper or wood pulp</td>
<td>75</td>
<td>26 tons* (44 tons)</td>
</tr>
</tbody>
</table>

* Exceeds maximum permissible weight.

With such heavy containers, a ship could only carry 75% of its design capacity since it would achieve maximum weight before achieving maximum slot utilization. In North America, export containers tend to be twice as heavy as import containers because of the high percentage of commodities carried. If a ship is presented with a large share of containers volumes of more than 20 tons per TEU, adjustments in the distribution of this

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21 Assumes that a 20 foot container can hold 1,172 square foot and has a maximum load of 26 tons. The usual operational weight is around 24 to 26 tons.
load must be made, which delays the ship port turn time. An additional challenge resides in the weight restrictions of 47,900 lbs (23.9 tons) applied by railways. While CP limits weight to 23.9 tons, CN allows containers above this limit with a surcharge. At the port terminals, container weights of up to 52,000 lbs (26 tons) can be handled without restrictions.

**Slow Steaming and Schedule Reliability**

An emerging commercial practice in container shipping is described as "slow steaming", in which the operating speed is reduced from 24 knots to about 19-20 knots. Slow steaming is challenging for shipping companies and their customers as it is a response to higher energy prices and overcapacity. It ties more ships and container assets in transit and therefore compromises the availability of containers inland since the transloading option becomes more desirable when containers are scarcer. By 2011, about 50% of the world's container shipping capacity was operating under slow steaming and there is little sign that this practice will be discontinued, particularly in light of enduring high bunker prices. It is now part of standard operating conditions in maritime shipping.

Schedule reliability is a function of the frequency of deviations between the actual arrival day and the estimated time of arrival (ETA). At the global level, container ships arrive at their ports of call on the scheduled day less than 50% of the time, with an average deviation of 1.3 days. For the two most important trade relations, Asia/Europe and transpacific, schedule reliability is consistent with the global average of 33% of the ships arriving 1 to 3 days late. The transatlantic has a much higher schedule reliability than the global average because the distances are shorter and pendulum services have less port calls.

Low levels of schedule reliability are problematic for supply chain managers since it ties up more inventory in transit and forces last minute adjustments for terminal pickups and deliveries to distribution centres. Schedule reliability is less a concern for containerized commodities as they tend to be less time sensitive, except for the reefer trade, for which timeliness is crucial. Terminal operators are also forced to use more terminal space as a buffer to absorb the lack of reliability. Inland transport providers servicing the port terminals must also cope with the related fluctuations and uncertainty. At the aggregate level, it ties up more of their capacity for the same containerized volume.

**Assessment**

Shippers report that products such as lumber and wood pulp are the dominant commodities being exported in containers year-round and roughly account for 35% to 40% of total exports. Other key commodities are scrap metal, plastic and waste paper, accounting for 40%, and reefer cargoes (meat such as frozen pork) accounting for 8%. Agricultural goods are significant and generate around 15% of the export volumes, but
they have a high seasonality. These observations match closely with the containerized export traffic reported by Port Metro Vancouver (see Figure 10).

Maritime shipping companies remain receptive to opportunities to promote Canadian exports since it provides additional business and helps rectify imbalances in the allocation of their container assets. However, they will do so if there is a clear business case that takes account of the operational complexity of effectively reconciling import and export logistics (Table 3). This implies that any transport chain where shippers can at least recover their cost and develop profitability would see greater levels of container commitment. Although the setting of inland ports may provide an incentive to revise their strategy, historically the commodity trade did not provide significant revenue for carriers. A carrier sums up the situation, as follows:

“... if landside costs are covered and the cargo provides competitive market ocean freight rate contribution, then the chances are much better that a carrier may take a second look at any hinterland opportunities.”

Table 3 - Main Carriers’ Operational Constraints

<table>
<thead>
<tr>
<th>Factor</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imbalanced trade flows and rates</td>
<td>Availability of empty containers at North American gateways. Export subsidy at some ports because outbound rates lower than inbound rates.</td>
</tr>
<tr>
<td>Inland freight rates</td>
<td>Higher inland freight rates and terminal costs (lower dwell time at rail terminals)</td>
</tr>
<tr>
<td>Location and load availability</td>
<td>Shipping companies prefer containers to stay in the vicinity of port terminals. Load mismatch (40 footers preferred for inbound while 20 footers preferred for commodities).</td>
</tr>
<tr>
<td>Commodity price volatility</td>
<td>Short term export contracts (commodities) as opposed to stable import contracts (retail).</td>
</tr>
<tr>
<td>Container weight</td>
<td>Heavier containers for commodities (weighing out before cubing out)</td>
</tr>
<tr>
<td>Slow steaming and schedule reliability</td>
<td>More containerized inventory tied in transit.</td>
</tr>
</tbody>
</table>

How these factors specifically apply for inland ports or inland destinations within Western Canada must be assessed on a port to port basis. Such a consideration as set out in Table 3 plays an important role in the market potential of an inland port.

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22 Source requested to be anonymous.
E. Transloading and Stuffing: Two Sides of the Same Coin

The Rationale of Port-Centric Transloading and Stuffing

Transloading refers to the transfer of goods from one container to another. It mostly concerns imports being transloaded from maritime (e.g. forty foot) into domestic containers (fifty three foot). Stuffing relates to loading commodities into containers at a location (port or inland terminal) to which they have been brought in bulk (trucks or rail). It mostly concern exports being placed into maritime containers. The current state of containerized freight distribution underlines that the containerization of commodities has shifted to the port-centric logistics of transloading and stuffing as shippers find it more cost effective. This takes place somewhat at the expense of the hinterland in terms of the availability of containers.

The significant growth of transloading has several drivers (Table 4). The first and most significant driver concerns the principle of consolidation of load units. In North America the largest domestic load unit is the 53 foot container, which represents for most jurisdictions the maximum legal length of a truck load on the highway. Thus, in distribution centres in the vicinity of major port terminals such as Vancouver, the contents of three maritime containers are transferred (transloaded) into two domestic containers. This enables cost savings as shipment costs, including terminal costs, are established in terms of loads being handled. Rail terminals charge their customers by the number of lifts, which means that it costs the same to handle a 40 foot or a 53 foot container. Under such circumstances, transloading costs are compensated by savings on inland transport costs, which can be in the range of 30% when compared with the inland transportation cost applicable to the movement of maritime containers inland. Yet, transloading involves some risks such as damage and theft or additional delays to perform (about one day), which may not be suitable for very high value and time sensitive goods.

Equipment availability and utilization are also a factor of significance as transloading enables a more efficient use of both container assets (international and domestic) and can facilitate international trade by freeing transport capacity for exporters around the port. For instance, moving maritime containers over long distances within the North American transport system can be considered a suboptimal usage of transport equipment, particularly from the perspective of maritime shipping companies. Conversely, the global maritime shipping industry is mainly designed to handle 40 foot containers and cannot accommodate domestic containers. However, a large amount of transloading for inbound shipments may reduce the availability of maritime containers available for export at inland locations. This is a problem for the export of containerized
commodities and results in a convergence of stuffing activities in the vicinity of port terminals. Moving empty containers from the East Coast to the upper Midwest where commodities are available for exports is costly. There is thus a business case to move commodities by bulk to port facilities where transloading makes available a pool of containers for exports.

A transloading facility can act as a buffer within a supply chain, enabling shippers some room to synchronize the delivery of goods with the time requirements of their customers. This is particularly the case for long distance trade where a shipment can be in transit for several weeks while the demand conditions at the destination may have meanwhile changed. Transloading enables to delay the decision about routing freight to the final destination by using the facility as an opportunity to do last minute adjustments in terms of which shipments should go to which markets. Another common supply chain practice concerns the assembly and consolidation of loads for a specific market which transloading offer. For instance, large retail importers commonly purchase goods from several foreign suppliers. Transloading offers the opportunity to consolidate the loads for specific regional distribution centers or stores. In this context the transloading facility performs a function similar to a cross-docking facility. Also, transloading represents an opportunity to perform some added value activities (packaging, labeling, final assembly, etc.) before shipments arrive at final markets. It works well when long inland distances and several regional distribution centers are concerned.

Shipping options are also a factor considered by freight forwarders and commodity exporters as transloading expands the commercial opportunities of their cargo. Bringing commodities to the port gives more options in the choice of a shipping line and finding a better rate due to increased competition. From a transactional perspective, putting commodities in containers inland "locks" the commercial options of the seller, particularly if a shipping line container is used.

| Table 4 - Rationale of Container Transloading |
|---------------------------------------------|-------------------------------------------------|
| **Cause**                                   | **Outcome**                                     |
| **Consolidation**                           | Transferring the contents of smaller containers into larger containers (e.g. three maritime 40 foot containers into two 53 foot domestic containers). Cost savings (number of lifts). Time delays. |
| **Weight compliance**                       | Transferring the contents of heavy containers into loads meeting national or regional road weight limits. |
| **Demurrage**                               | Handing back containers to owner (maritime shipping or leasing company) by transferring its contents into another |
load unit (e.g. domestic container) thereby reducing the charges on the maritime container.

**Equipment availability**  Making maritime containers available for exports and domestic containers available for imports. Trade facilitation.

**Supply chain management**  Terminal and transloading facility as a consolidation buffer. Delay decision to route freight to better fulfill regional demands. Perform some added value activities (packaging, labeling, final assembly, etc.)

There are consequently several factors that challenge the containerization of commodities at inland locations, which have benefited Port Metro Vancouver.

**Vancouver: Canada’s Commodities Export Gateway**

Port Metro Vancouver with a volume around 2.5 million TEU in 2011 is in a unique situation in North America because it is the only major port where inbound and outbound containerized volumes are fairly balanced (Figure 7). This balance is mainly attributed to the commodity trade since Vancouver breaks away from the North American pattern where import cargo is 2 to 3 times the volume of export cargo. Still, since 2001, Port Metro Vancouver has shifted to a small extent from an export-oriented port towards a more prevalent import function, but firmly remains Canada’s commodities export gateway. In 2000, the ratio of loaded export containers over loaded import containers was 1.2, meaning that for every 1.2 TEU of loaded exports there was one TEU of loaded imports. By 2011, it was 0.8. This is in part attributed to the decision in 2001 by OOCL, NYK and Lykes Lines (purchased by Hapag Lloyd in 2005) to call Vancouver first on their transpacific routes with strategic pendulum routes to the production clusters of Pacific Asia. This accelerated the shift in the general balance of inland freight traffic and a change in the port’s hinterland with a growth of new markets reaching far inland (e.g. Toronto). Three major terminal operators are present; DPW (Centerm; formerly P&O), Global Container Terminals23 (Vanterm and Deltaport) and Macquarie Infrastructure (Fraser Surrey Docks).

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23 Global Container Terminals is owned by the Ontario Teachers’ Pension Fund.
The growth of the share of import loaded containers has brought in an additional volume of empty containers available for exports, from which the transloading of inbound maritime containers into domestic containers and stuffing of outbound maritime containers with commodities benefited. Still, there are additional opportunities to better capture export opportunities as in 2010, 10.2% of all TEU handled by the port involved outbound empty containers, while this share was 5.7% in 2000. This pales in comparison with a port such as Los Angeles where this share was 26.8% in 2010 (45.8% of all outbound containers were empty). Traffic growth in 2011 came to a standstill since the port handled a similar level of TEUs as of 2010. The only marginal difference is that the share of loaded exports increased, implying that containerized commodities were the main driver in the change in the traffic composition.

An overview of the composition of maritime containers underlines that 40 foot containers account for about 71% of the total traffic handled, while 20 foot containers account for about 27% of the total (Figure 8). This highlights that the dominant load unit of Vancouver is not the ideal load unit for containerized commodities.

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24 Source: Port Metro Vancouver.
The emergence of the port-centric transloading and stuffing business took time to be adopted. In the mid-1990s, Port Metro Vancouver was initially involved in the development of transloading facilities. The issue was that the private sector was initially skeptical about the commercial potential, but this potential became evident with the rising North American demand for imported goods as well as the transpacific demand for commodities. Several transloading centres were established by third-party logistics providers, shipping companies and rail operators to service specific supply and commodity chains. Transloading and stuffing activities are now entirely performed by the private sector. A study undertaken for Transport Canada in 2007 underlined that for cargo bound to an Eastern Canada destination transloading in Vancouver could involve economies in the range of 25% compared to moving the same load in 20 foot containers.

Source: Port Metro Vancouver.
The composition of imports to Port Metro Vancouver is quite typical of the majority of large container ports in North America, particularly along the West Coast, with household goods being the dominant cargo handled (Figure 9). These goods are mostly bound to the distribution centres of major Canadian retailers. It is also clear that there
are significant weight differences between containerized imports and exports; at an aggregate level, containerized exports were 29% heavier than imports.

The composition of containerized exports is reflective of the nature of the Western Canadian economy and of the proximity effect (Figure 10). Lumber, wood pulp and specialty crops\(^{27}\) account for 64.3% of the volume of exports. Lumber is the most important driver for Port Metro Vancouver as it accounted for 32.2% of exported TEUs in 2011. This driving force was underlined in 2011 when CN and the Chinese company CNBM Forest Products Trading agreed to undertake the transloading of lumber into containers at their Thornton Yard facility in Surrey, which has a capacity of 10,000 containers per year\(^{28}\). Canola accounts for the dominant share of specialty crop exports.

The modal breakdown of the inbound containerized traffic underlines a predominance of rail; 65% of import containers are put on rail, 20% are transloaded and then put to rail or trucks and 15% are directly put on trucks. Therefore, the amount of maritime containers going inland remains substantial. The impact of transloading on inland container availability is notable, but there are other factors at play, namely the locations where those containers are bound to. The outbound rates per TEU are just below break bulk rates, implying that break bulk ships do not compete effectively with containerships in Port Metro Vancouver. Concerning coal, there are no export facilities on the US west coast, so any transpacific growth in the demand, particularly for high grade coal, would likely involve its direct containerization. However, the potential to containerize specialty coal in Western Canada is unclear.

Due to their relatively low weight to value ratio, commodities tend to be much more influenced by transport costs than other products such as retail goods. This implies that commodities relatively close to port facilities will be tapped first, even if more valuable opportunities may be available inland. For instance, there is an active waste paper containerized export trade in Los Angeles / Long Beach because recyclables are the available commodity in the closest proximity. For Vancouver, this trade is of less significance (and declining), but still accounted for 5.2% of containerized exports in 2010. It could be inferred that the setting of inland ports could spur, at least temporarily, the export of recyclable goods.

While the growth potential for transloading and stuffing in the Vancouver metropolitan area appears notable, there are some mitigating factors that could impede this growth. Congestion issues (last mile) are problematic, underlining some risks with the access to the various port and rail terminals as containers have to be drayed between terminals and transloading sites. Additional congestion caused by trucking could trigger regulatory responses, which could impede additional transloading developments. In the medium

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\(^{27}\) Specialty crops include fruits and vegetables, tree nuts, dried fruits and horticulture and nursery crops.

term (10 years), the availability of land to support the development of additional port-centric logistics activities could become an issue in the Vancouver metropolitan area as the real estate base is limited.

**Prince Rupert: New Gateway, New Potential**

The Port of Prince Rupert represents a new gateway for containerized traffic on the North American West Coast. Its traditional role as a bulk commodity export port (mainly coal and wheat) has been expanded in 2007 with the opening of the Fairview container terminal, of a capacity of 750,000 and operated by Maher Terminals. In 2011, the port surpassed the 400,000 TEU landmark, implying that it is in theory running at 50% of capacity. The fast growth of the traffic has put pressures on additional capacity expansion, which should reach 1.2 million TEU in 2010 with additional terminal equipment and rail connectivity. The second expansion phase scheduled between 2014 and 2020 would put the port at a 2 million TEU capacity.

An important value proposition for Prince Rupert concerns deep drafts (deepest on the west coast) and two days less transpacific transit time compared to other West Coast ports. It provides an option for the increasing congestion and delays (gate access) at Port Metro Vancouver. Still, for supply chain managers the “Prince Rupert option” is more complementary to the “Vancouver option”; a container delivered in Prince Rupert can reach a Western Canadian market before it could be available at a terminal at Port Metro Vancouver.

The port is being marketed as a direct gateway for the American Midwest with maritime shipping and rail services organized as such. Prince Rupert remains an import port, but the share of loaded exports is increasing significantly. Loaded containers accounted for 57% of the port’s export traffic in 2011, while this figure was 35% in 2009. There are essentially no empty container imports (Figure 11). This is indicative of the growing role commodities are taking in the port’s traffic.

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29 Maher Terminals is owned by the German investment bank RREEF (a subsidiary of Deutsch Bank) and also operates Maher Terminal at Port Elizabeth in New York.
The growing availability of empty containers at Prince Rupert is encouraging the development of a regional export market. The key export commodities within the region are lumber, aluminum ingots, waste paper, scrap steel, chilled poultry and chilled seafood bound for the Asian markets. The emergence of a reefer trade underlines the time advantage of Prince Rupert in relation to main Asian consumption centres, which gives additional shelf life for chilled goods. If chilled goods are source loaded into reefers, the “Prince Rupert option” may confer about five additional days of shelf life on Asian markets, thus improving the profitability and commercial viability of such a trade. Frozen meat and fish are at a lower premium because of the degradation of quality freezing implies as opposed to chilled meat which is kept just above freezing temperature. The additional potential for the containerization of commodities in Northern British Columbia remains good as 75,000 TEUs were still exported empty in 2011. The case of Prince Rupert underlines that the availability of empty containers at a location is a strong factor inciting the development of trades taking advantage of empty backhauls.

Moving Transloading Inland

There are also indications that some transloading activities are moving inland as maritime shipping companies are receptive to such options. For instance, Calgary now carries some transloading activities that previously took place in Vancouver, particularly

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30 Source: Prince Rupert Port Authority. Note: traffic figures for 2007 are aggregated.
31 “Gateway to Success?”, Dredging and Port Construction, Mai 2010, pp. 36-43.
because of market size and the availability of domestic containers for regional distribution within Alberta. Since Alberta is a significant consumption market there is a mass of retailers large enough to support transloading containers brought by rail from Vancouver or Prince Rupert. With a quick rotation, Western Canadian commodities could be stuffed into containers or those containers could quickly be brought back to Vancouver or Prince Rupert to be repositioned empty across the Pacific, or made available for local exports. This implies that if regional conditions are suitable, more transloading activities could take place at inland ports in Western Canada and therefore provide additional pools of empty containers for exports.
F. Railways and the Containerization of Commodities

The Western Canadian Intermodal Rail System

The location of intermodal rail terminals in North America is a balancing act between gateway location, market density, interlining and complementarity with trucking. The great majority of inland load centres in Western Canada are serviced by two operators, Canadian National (CN) and Canadian Pacific (CP), which confers a level of competitiveness and offers options for regional shippers (Figure 12). The market density is low implying that CN and CP generally operate one intermodal terminal in each main metropolitan area. As long as a minimal volume of about 20,000 container moves per year can be generated, an intermodal terminal is likely to be established\(^{32}\). Each terminal acts as a load centre for a large market area, requiring extensive drayage. The corridor between Prince Rupert and Edmonton is solely serviced by Canadian National with Prince Rupert and Prince George offering one intermodal rail option with limited drayage options to other intermodal terminals. Regina is in a similar situation with an intermodal terminal operated by CP, but drayage to Saskatoon is a possibility.

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\(^{32}\) The minimum efficiency scale of an inland intermodal terminal does not have a fixed number of lifts since it is dependent on a number of factors such as the price of land, market density and the terminal equipment. Several of these issues are discussed in B.C. Ministry of Transportation and Infrastructure (2006) Inland Container Terminal Analysis, IBI Group.
The Western Canadian intermodal rail system encompasses intermodal trains originating or bound to specific terminals in the Vancouver metro area and connecting to the major eastern Canadian markets. More than 65% of the containers handled by Port Metro Vancouver are put on intermodal trains mainly bound for Toronto and Montreal. The cost to move a container by rail between Vancouver and Toronto is about $1,500. The volume of transborder intermodal rail traffic is relatively small in British Columbia and Alberta (about 14% of the intermodal traffic entering the United States from Canada) as most of the transborder interactions take place in Saskatchewan, Manitoba and Western Ontario (about 36% of the intermodal traffic) where the rail corridors branch to service Chicago (Figure 12).

Long distance import intermodal hauls are generating significant income for railways, but capacity issues have been a concern, particularly in the vicinity of Vancouver. A logical outcome in the growth container volumes coming out of Vancouver has been to increase the intermodal density of trains. While 22 feet per TEU was the norm, this figure was improved to 18.5 feet per TEU. CN has the ability to assemble intermodal trains of up to 10,000 feet while CP can assemble intermodal trains of 15,000 feet.

Railways have also embarked on greater accountability and transparency in meeting customer commitments for transits moving through multiple terminals. For instance, CN addressed this issue in 2010 by instituting a supply chain scorecard that specifies performance targets and service measures, and calls for balanced accountability among
supply-chain participants to provide better end-to-end transportation solutions that would help mutual customers compete more effectively in end markets.

### Railways and the Containerization of Commodities

Railways, like any transport activity, benefit from the growth of traffic and will invest in facilities supporting exports. CN handled about 125,000 bulk grain cars to export terminals at the Port Metro Vancouver and the Port of Prince Rupert. For the 2010/11 crop year, CN moved 6.7 million tons of grain (half of which was canola) through Port Metro Vancouver, and 4 million tons of grain through the Port of Prince Rupert.

A high priority strategy concerns a better integration with shipping lines and increasing the velocity of freight through better levels of intermodal asset utilization. In line with maritime shipping companies, railways are facing an imbalanced weight structure between import and export containerized flows. The growth in containerized commodity flows is challenging for the intermodal equipment, with CN and CP imposing a weight limit on 20 foot containers of 23.9 tons (CN will handle heavier containers with a surcharge). This leaves shippers about three to four tons short of the maximum load capacity of a 20 foot container.

It is important to underline that railroads earn revenue for moving commodities in hopper cars from Western Canada to the West Coast ports. Yet, there is a revenue cap issue for grain transportation, which if removed, would have uncertain consequences on bulk rail freight rates. The revenue cap was established through the Canadian Wheat Board to ensure stability in transport prices for grain exports. In the current conditions, stuffing commodities in containers on the return trip instead of using boxcars may remove some revenue since railways will have to reposition empty containers to the West Coast anyway. Still, for specific corridors, railways are actively promoting the containerization of commodities when there is a commercial potential.

In view of the acute imbalances between import and export container flows, railways have established with maritime shipping companies domestic use programs where they are trying to provide one or two domestic repositioning moves as a revenue source and as a service to their customers. Such a strategy offers opportunities in the containerization of commodities as containers that would normally be repositioned empty to a port terminal may be available at an inland port for the carriage of domestic freight to the ocean port.

The growth of the containerized commodity trade is also causing railways to reassess their intermodal terminal designs. The most significant commodity related changes include:

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33 Mongeau, C. CN President and Chief Executive Officer. 5th Annual Canada Maritime Conference. Montreal, Canada. September 15, 2010.
- Building specialty grain transloading / stuffing facilities next to intermodal terminals as it provides additional volumes and insure a quick rotation between import and export containers. For instance, in 2008 CN opened a $6 million grain transload centre in Chicago (Chicago Grain Distribution Centre) that stuffs grains into empty containers for export to overseas markets (mostly Asia). Additionally, a $20 million forest products intermodal terminal and distribution centre was established in Prince George as well as a $4 million grain transload terminal in Edmonton in 2006. A corridor-wide approach in the containerization of commodities is emerging between Prince Rupert and Chicago.\(^{34}\)

- The capacity to use a rail terminal to both ship commodities in containers and by bulk is considered as a risk mitigation strategy able to cope with fluctuations in the availability of containers, in the price of commodities and the availability of both intermodal and bulk equipment. Even though the modal preference may shift, due to factors outside the rail operator’s control, export moves would still use the same terminal facility.

- Having mobile container stuffing equipment is perceived to be an advantage to cope with the fluctuations in the demand (seasonal & location).

In their Western Canadian operations, railways are following the trend towards a co-location strategy when developing new terminals (e.g. CN project in Calgary and CP project in Regina). Among many other advantages, co-location creates a cluster of importers and exporters being able to more effectively use intermodal equipment (containers and chassis). In both cases, they expand the railway’s business. All of the above could lead to novel forms of terminal use and management, rather unique to the Western Canadian setting because of the regional composition of the export cargo.

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G. Inland Ports as Emerging Logistics Platforms

There is a wide variety of terms that have been used to refer to inland freight facilities both in the academic and commercial literature. The reason for this lies in the multiple shapes, governance, functions and network positions these nodes can have. The nodes in the hinterland networks of ports have been referred to as dry ports, inland terminals, inland ports, freight villages, inland hubs, inland logistics centers, among a few. Thus, there is no clear consensus on the terminology to be used to describe such facilities, but the terms dry port and inland port have become the most prevalent terms. This leads to a multiplicity of claims by stakeholders involved in the development and promotion of facilities or business plans that their project is essentially an inland port.

This report does not claim to mitigate the apparent confusion about what an inland port should be since they can take shapes ranging from a consortium promoting the development of freight real estate within its region (often a metropolitan area) to a specific intermodal rail facility developed in co-location with distribution centres. Yet, it is observed that in North America, inland ports were developed as inbound logistics platforms trying to better coordinate a variety of stakeholders such as railways, importers, exporters, levels of government and real estate developers.

The Value Proposition of Inland Ports

As global and North American integration continues, the next step involves the setting of inland ports as cargo rotation platforms to reconcile inbound and outbound logistics, as the regional export potential grows. The viability of each inland port depends on a number of considerations including, modal availability and efficiency, market function and intensity, as well as the regulatory framework and governance. The emergence of inland ports reflects some deficiencies in conventional inland freight distribution that need to be mitigated. These deficiencies include:

- **Land value.** Many deep sea terminal facilities have limited land available for expansion. This favours the intensification of activities at the main terminal and the search of lower value locations supporting less intensive freight activities, such as transloading. Inland ports are dominantly developed in suburban settings a good distance from central areas, which confers the availability of a sufficient land base at a lower cost. The Western Canadian setting is particularly advantageous over this dimension as the Vancouver metropolitan area is facing land availability issues.

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• **Capacity and congestion.** Capacity issues appear to be the main driver of inland port development since a system of inland terminals increases the intermodal capacity of inland freight distribution. While trucking may be sufficient in the initial phase of the development of inland freight distribution systems, at some level of activity, diminishing returns such as congestion (e.g. terminal gate access), energy (fuel consumption) and empty movements become strong incentives to consider the setting of inland ports as the next step in regional freight planning. This is particularly the case for locations that are within a day or two by truck from a port facility.

• **Hinterland access.** Inland locations tend to be less serviced by intermodal transportation than coastal regions. Through long distance transport corridors, inland ports confer a higher level of accessibility because of lower distribution costs and improved capacity. These high-capacity inland transport corridors allow ports to penetrate the local hinterland of competing ports and thus to extend their cargo base. In such a setting, the inland port becomes a tool for commercial and trade development that jointly increase imports, exports and intermodal terminal use.

• **Supply chain management.** In addition to standard capacity and accessibility issues in the hinterland, an inland port is a location actively integrated within supply chain management practices, particularly in view of containerization. This takes many forms such as the agglomeration of freight distribution centres, custom clearance, container depots and logistical capabilities. The inland port can also become a buffer in supply chains, acting as a temporary warehousing facility often closely connected to the warehouse planning systems of nearby distribution centres. Purchasers can even be advantaged by such a strategy since they are not paying for their orders until the container leaves the terminal, delaying settlement even if the inventory is nearby and available.

The modal availability and capacity of regional inland access have an important role to play in shaping the emergence and development of inland ports. Each inland market has its own regional potential for imports and exports requiring different transport services and modes of operation.

**Reconciling Inbound and Outbound Logistics**

In North America a number of inland ports initiatives have been developed with a focus on inbound logistics in light of the growing level of Asian imports and the need to provide economies of scale to cost effectively handle this traffic. The problem of reconciling import and export containerized logistics in Western Canada is due to different demand locations, different products, and different loads. The long distance transportation of containers to and from inland ports is facing an asymmetry between import-based and export-based logistics:
• Import-based containerized cargo tends to dominantly concern retail goods, implying that the distribution pattern is a function of the population density (mostly large cities). Since the majority of the population is urbanized, the distribution pattern is nodal but spread over the vast geography of Western Canada and up into the dominant consumption market of the Quebec – Windsor corridor. Import-based logistics tend to have a high priority as it is the segment that generates the most income for carriers. Due to trade imbalances (higher rates on inbound than on outbound containers), the value of the cargo and its timeliness, it tends to carry a higher premium than the backhaul cargo (see Figure 6).

• Export-based containerized cargo tends to include commodities where the origins are a function of resource density. They have a high level of concentration, but their location characteristics are very different than import flows. Export-based containerized cargo has a much lower value than inbound cargo, implying that its carriage has a lower priority for managers of containerized assets. This cargo has however the advantage of being less time constrained, unless related to the cold chain (e.g. perishables). The success of export-based containerized logistics is consequently dependent on the availability of containers inland and their repositioning.

Reconciling the availability of containers in a distribution system where imports and exports logistics are very different, faces the enduring problem of finding available maritime containers inland as repositioning costs are high. The hybrid solution that has been discussed involves using conventional bulk transport systems to bring commodities to the port where they can be transloaded into maritime containers. This hybrid solution may be transitory once sufficient intermodal volumes are generated inland, thereby negating the need for transloading at the port.

It is also worth considering the potential impacts of the expansion of the Panama Canal on the availability of empty containers in Western Canada. If a greater quantity of containerized traffic shifts to the East Coast, there would be greater pools for empty containers available for repositioning towards the West Coast. This would be particularly the case for containers bound to the American Midwest, areas serviced by CN and CP³⁶.

**Main Inland Ports and their Initiatives**

**Prince George**
Prince George is the main city of northern British Columbia and is about midway between Prince Rupert and Edmonton along a rail corridor owned and operated by CN.

While the nature of the economy, mostly revolving around forest products, did not commercially justify an intermodal terminal, the positive prospects of the containerization of wood products has encouraged CN to open in 2007 an inland box stuffing and de-stuffing terminal at Prince George. Volumes were initially modest, but traffic is picking up, driven by Chinese demand (see Figure 16). Traffic climber from 10,000 TEU in 2010 to 20,000 TEU in 2011 and are expected to reach 35,000 TEU in 2012. While the inland port is mostly servicing the new container port in Prince Rupert, the location confers the additional option to reach Vancouver by rail. The commercial potential of Prince George is contingent on the demand of containerized wood and pulp products in Asian markets. Prince George may find itself in a vulnerable position of offering a rather limited import market and be dependent on a limited range of commodities for exports. The success of Prince George as an inland port will be clearly affected by the price and demand fluctuations of forest products in global markets.

Port Alberta (Edmonton)37
Port Alberta in Edmonton is the most recent inland port initiative since it was incorporated in 2010. It is the outcome of a process spearheaded by regional stakeholders trying to assess the role and function of Edmonton within the North American freight distribution system. In itself, it does not own any land or assets. The Edmonton International Airport is an important driver behind the project with the expectation that several logistics development projects will take place in the vicinity of the airport since much of the available land is owned by the Edmonton Regional Airport Authority. The city has a well-developed intermodal and freight distribution sector that is the outcome of its enduring role of Northern Alberta’s dominant commercial centre, a function that was expanded with the growth of the energy sector. Further, the prospects of oil sands development have generated additional intermodal traffic, particularly in terms of supplies and equipment. Since Edmonton is the first major city along the rail corridor originating from Prince Rupert, the growth of containerized traffic has spurred an inland port initiative.

The governance structure of Port Alberta aims towards the formation of a “brain trust” similar to KC SmartPort in Kansas City where a stakeholders’ representative board is set and key issues are advocated. In this case, there are no intentions to be involved in terminal and logistics zone development, but to act in a manner consistent with an economic development office focusing on the promotion of freight distribution. This role is multifaceted, but leans on increasing linkages between regional actors and influencing decision-makers into strategies promoting the efficiency of regional freight distribution. Interestingly, the nature and extent of freight distribution within the metropolitan area is not well known, a main reason why Port Alberta has started to undertake an inventory of related enterprises within the region. With a clearer assessment of the regional dynamics of the distribution industry, Port Alberta aims at

37 http://www.portalberta.com/
playing a greater role to coordinate future regional strategies. A strategy that has been identified to improve commercial opportunities will match Port Alberta with other inland ports around the world, particularly in China. It is expected that such a venture would help more clearly identify import and export opportunities on both sides and help establish the corresponding supply chains. It remains clear that commodities will account for the dominant share of the containerized export opportunities.

**Calgary**

Unlike Edmonton, Calgary does not have a formal inland port initiative but is already a comprehensive inland port with air, rail and distribution centre facilities. In recent years, significant developments of new distribution centres have taken place within the city and the region acting as the effective distribution hub for Western Canada. The setting of a new intermodal facility by CN at Conrich (Rocky View County northeast of Calgary), expected to open in 2013, will also involve the setting of a logistics park and a new dynamism in freight distribution. This intermodal facility with a capacity of 500,000 lifts and the co-located 680 acre park would create an inland port facility that would add to the existing CP terminal. Jointly, these intermodal facilities will have the highest capacity in Western Canada and therefore with economies of scale (more train stops and higher frequency of services), Calgary is likely to become increasingly attractive for the distribution centres of major retailers. At the same time, the availability of empty containers will promote regional cargo rotation and containerized commodities exports. Under such circumstances the Calgary region and Southern Alberta are likely going to become the largest commodities intermodal platform in inland Western Canada.

**Global Transportation Hub (Regina)**

Global Transportation Hub (GTH) is a new inland port initiative located west of Regina on a 2,000 acres greenfield site owned by the GTH. As a crown corporation, a special operating agency of the Government of Saskatchewan, GTH is able to leverage public investments in infrastructure, mainly local roads and access ramps, which a new site is bound to require in its initial investment phase. Since Regina has not been a site that traditionally attracted significant freight distribution investments, it was seen as particularly important to reduce as much as possible the perceived risks of setting logistics activities at a new location and in a new regional market. The main risk factors are the infrastructure keeping pace with the level of activity as well as the availability of labor in a low density province such as Saskatchewan. Other services that are common to many inland port projects are offered, namely a single window to address all services and regulatory issues, such as the provision of infrastructures in a manner consistent with the tenant’s needs and development plans.

So far, GTH has been able to attract three major anchor tenants; Loblaws (a major Canadian food retailer), Yankee Trucking and CP Rail. The CP Rail commitment is

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38 [http://www.gtha.ca/](http://www.gtha.ca/)
particularly important since it concerns the setting of a new intermodal terminal scheduled to become operational in December 2012 and with a capacity of 250,000 lifts (a mid-sized terminal by North American standards). Once the new facility is operational, the old facility near downtown Regina will be closed, with its traffic effectively transferred to the GTH terminal. Since a new intermodal facility is a long term infrastructure and capital commitment, CP will try to insure that the facility is used and will offer intermodal services accordingly. The Loblaws distribution centre opened in 2010 with a new expansion phase under way and will be fully operational in June 2012. This will involve an active inbound reefer trade that may offer opportunities for cold chain exports, particularly in the meat sector. At this point, there are no commitments from commodity exporters to use the co-located logistics zone, but it is reasonable to expect that once the new CP intermodal terminal becomes operational, many commodity export companies, particularly in the specialty grain sector, will seriously consider GTH as a suitable location for transformation and container stuffing activities. The opening of GTH and the setting of a new co-located intermodal rail facility represents a unique opportunity for importers and exporters to re-assess their location and supply chain management strategies.

CentrePort Canada (Winnipeg)

CentrePort Canada (CPC) is a private sector, non-share capital corporation with a board of 15 directors established in October 2008 with the mandate to facilitate the development and operations of an inland port over CentrePort Canada land area, to foster investments in the inland port area and to market the inland port both domestically and abroad. As such CentrePort Canada is a support structure for the strategic planning of freight distribution activities within its designated area. CentrePort land area is about 20,000 acres of land owned by various public and private actors, 900 of which belong directly to CPC. This represents the largest logistics zone in North America in terms of allocated land. Since the Winnipeg International Airport is part of the CPC initiative, the capacity to handle air freight is an attribute expected to expand development opportunities. Because of its location and jurisdiction, CPC is also focuses on opportunities for transportation and trade in the arctic.

CPC in many ways resembles an economic development agency responsible to promote and coordinate the development of freight distribution activities within its jurisdiction. Therefore, several privately owned industrial parks are being setup and developed independently within CPC. The location of industrial and logistics activities is gaining momentum as since mid-2010 about 55 acres were sold to 14 companies. Like most

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39 [http://www.centreportcanada.ca/home](http://www.centreportcanada.ca/home)

40 This real estate was acquired by the Province of Manitoba. Additionally, CPC does not own any assets such as warehouses.

41 The second largest, Alliance Texas, has 17,000 acres.

42 As of December 2011.
greenfield initiatives, several infrastructure projects are being set to insure that the inland port effectively supports the activities located within its jurisdiction, particularly the traffic they generate. The three most important infrastructure projects are:

- CentrePort Canada Way, which is a $212 million expressway project that will more effectively link, once completed in 2013, the inland port to the regional highway system.
- Water and wastewater utility system to service 1,100 acres, corresponding to the first phase of the inland port development.
- A project to develop a common use rail facility within the inland port premises, which would be the only such intermodal terminal in Canada. This could trigger additional co-location advantages for logistics activities with a neutral intermodal rail terminal.

Winnipeg offers a substantial population and manufacturing base in Western Canada and is the point of convergence of the transcontinental lines of CN and CP. This results in a notable inbound containerized trade and trying to balance these imports with exports is one of the objectives of CPC. Its central location also creates options that are less available to other inland ports, including services to alternative gateways. While access to East Coast gateways, mainly Montreal, is a conventional and well serviced alternative, the setting of the Mid-Continent corridor linking Winnipeg to Kansas City, Laredo and the Mexican port of Lazero Cardenas is indicative of additional commercial opportunities. As far as commodities are concerned, the main containerized exports are canola, soybeans and distillers dried grains. Due to the strength of the agribusiness sector in Manitoba, specialty grains remain the most viable opportunity for containerized exports.

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43 In all instances, intermodal terminals, with the exception of some on-dock rail facilities, are owned and operated by either CN or CP.
44 Mainly used depending on the grain type by breweries, cattle feeding or ethanol plants.
H. Commodity Exporters: Market Potential and Challenges

This section investigates commodity specific opportunities. The containerization of commodities remains a niche market to be fully assessed by those involved in their production, transformation, marketing and distribution. The methodology to effectively assess the potential of the containerization of commodities will include considerations of commodity price, empty backhaul opportunities, container shipping rates, commodity demand in foreign markets and commercial interests compared to the convenience and cost of bulk shipping. For commodity exporters, having access to an adequate supply of containers at inland facilities is dependent on the commodity value and the market potential being substantial enough to assume the a) transportation costs, and b) the repositioning of containers to a commodity stuffing site.

Dominant Containerized Commodity Trades

Canada’s trade figures clearly underline the importance of commodities for exports. Although, Crude oil accounts for 13% of the total value of Canadian exports, it is difficult to containerize. Figure 13 depicts the export value of selected commodities that have a potential to be containerized (coal and iron ores to a much lower extent). These commodities accounted for 10.6% of the value of all exports in 2010.
A more detailed perspective shows significant geographic and commodity-related variations in exports (Table 5). Except for wood pulp (and lumber) the containerization of several commodities rarely exceeds 2-3% of the total exported weight.

Table 5 - Major Commodities Exports by Canadian Port Region, 2008-09

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Volume (2008-09) in thousand tons</th>
<th>% Containerized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-metallic minerals</td>
<td>8,647.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Refined petroleum and coal products</td>
<td>2,393.7</td>
<td>0.45</td>
</tr>
<tr>
<td>St. Lawrence Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>11,211.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Oil seeds and nuts and other agricultural products</td>
<td>3,378.6</td>
<td>7.3</td>
</tr>
<tr>
<td>Metallic waste and scrap</td>
<td>3,213.1</td>
<td>3.0</td>
</tr>
<tr>
<td>Pacific Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>17,466.4</td>
<td>0.7</td>
</tr>
<tr>
<td>Canola</td>
<td>11,765.3</td>
<td>0.65</td>
</tr>
<tr>
<td>Wood pulp</td>
<td>9,726.7</td>
<td>53.45</td>
</tr>
<tr>
<td>Sulphur</td>
<td>8,837.4</td>
<td>0.85</td>
</tr>
</tbody>
</table>

45 Source: Canada’s State of Trade: Trade and Investment Update 2011, Foreign Affairs and Foreign Trade Canada.
Although the containerization potential of each commodity group is not being assessed in this study, containerized exports figures by Port Metro Vancouver provide an accurate composition of the existing level of containerization of commodities for Western Canada, which remains the port’s main hinterland (Figure 14).

Figure 14 - Total Containerized Cargo Handled by Port Metro Vancouver, 2010

Lumber and wood pulp accounted respectively for 15.9% and 10% of the total TEU handled by Port Metro Vancouver, while specialty crops accounted for an additional 9.6%. The importance of the commodity sector is the main explanatory factor behind the balanced composition of containerized imports and exports for the port, which are rather unique in North America. The price evolution of key Canadian commodities that are exported in containers is very revealing (Figure 15). It underlines what has been observed at the aggregate level through the CRB index (see Figure 3). A situation of relative long term price stability that prevailed until 2000 has been replaced by an inflationary cycle in the price of commodities. Canola (rapeseed) oil, wheat and potash, for instance, were as of 2011 three to four times more expensive on global markets than they were in 2000. This makes them increasingly cost effective as containerized cargo.

Source: Port Metro Vancouver.
Figure 15 - Price of Selected Commodities on Global Markets, 1991-2011 (Jan 2000=100)\textsuperscript{48}

Pulp and lumber represent a unique opportunity with several factors explaining the importance of this containerized export trade in Western Canada. Packaged lumber is the most important traffic driver for Port Metro Vancouver as it represents about 25% of export TEUs. Lumber offers good packing density in containers (about 44 pounds per square foot for 2x4s). The volume of a 20 foot container can be fully used (about 25 tons fully loaded) without exceeding weight limits. There are limited sunk costs in starting container stuffing facilities because these facilities are relatively simple and do not require much capital. An available rail spur\textsuperscript{49}, a yard and a few forklifts are the basic requirements to have an operational containerized lumber stuffing facility.

The potential in British Columbia to further expand lumber exports has triggered the setting of a new CN intermodal facility at Prince George in 2007. As most of the lumber comes from British Columbia, repositioning empty container assets is less problematic as the distances are shorter. Canadian softwood exports to China have surged to 3,122.7 million of board feet in 2011, up from 495.2 million board feet in 2008 (Figure 16), which resulted in six times more traffic in a period of just three years. This is in part attributed to efforts by the Canadian Government and wood industry interests to


\textsuperscript{49} Construction costs of a rail spur are about $200 per foot.
influence a change of the Chinese building code in 2008 so that wood frame structures could be used for construction\textsuperscript{50}. This change helped expand BC’s containerized export market for finished lumber and wood building materials. It is not surprising that lumber stuffing facilities are being established or expanded in Vancouver and Prince Rupert by Chinese interests.

![Graph showing Monthly Softwood Lumber Shipments to China, 2007-2011](image)

**Figure 16 - Monthly Softwood Lumber Shipments to China, 2007-2011\textsuperscript{51}**

In 2010 the Canadian Wheat Board (CWB), the world’s largest wheat trader, sold 15.5 million tons of wheat and 5.5 million tons of other cereals, in international markets. The containerization of wheat remains limited in Canada, as opposed to the United States, due to the monopoly that the CWB has on wheat trade. Wheat is moved in bulk through export ports as the CWB manages large volume transactions with foreign grain purchasers. This mass market does not service well smaller exporters and importers; it does not leave room for niche wheat grain trades. It is therefore through the specialty grains trade that containerization has made the greatest advances.

Specialty grains are generally not considered as bulk commodities but as specialized food products since they do not usually move in 100 cars bulk trains\textsuperscript{52}. Canola is seen as a particularly important crop. In 2010/11, Canada exported three to four million tons of the rapeseed, 800,000 tons of canola oil and 1 million tons of canola meal. This


\textsuperscript{51} Source: Canada Statistics, COFI, Foreign Agricultural Service.

\textsuperscript{52} Pulse Crop News, Fall 2007. [http://www.pulse.ab.ca/Portals/0/pcn/PCN%20Fall%202007.pdf](http://www.pulse.ab.ca/Portals/0/pcn/PCN%20Fall%202007.pdf)
represents 50% of the grain handled by West Coast ports. The fact that canola oil has increased in price by a factor of four since 2000 (see Figure 15) and that a 20 foot container can be fully loaded without exceeding its weight limit with canola products are factors reflecting its successful containerization.

Lentils and other pulse products (e.g. peas and beans) have a high protein and carbohydrate content, a long shelf life (when dried) and can be packed without much degradation. As such, pulses have experienced a remarkable growth in their containerized trade. Figures for 2007 underlined that about 46,000 TEUs (1 million tons) of pulse crops were shipped from Vancouver, which account for the most significant Canadian agricultural containerized export. India, Turkey and Bangladesh accounted for 46.2% of Canadian lentils exports in 2009-10, particularly because pulses are an important part of dietary preferences in these countries. These exports are dominated by Saskatchewan with Alliance Pulse (Regina) being the largest exporting company. It is expected that containerized pulse exports are going to increase because of demographic growth and the important role pulses play in the diet of developing countries.

The seed industry offers a good potential for containerization. First, seed grain is of much higher value, making it a cost effective containerized cargo. Second, it is used in much lesser volumes, implying that economies of scale are of lower importance in its distribution. The nature of its final use is relevant as a whole container of seed grain can be used for a large farm; the container as a distribution unit is therefore suitable for the end use of seed grain. It is also important to prevent the contamination of seed grain (load integrity), a function that containers are well placed to fulfill.

High grade potash is also a commodity of interest for containerization, particularly in light of the very strong valuations that potash has experienced in recent years; potash was four times more expensive in 2011 than in 2000.

**Strategies to Promote Containerized Commodity Exports**

In addition to infrastructures, such as intermodal yards, and the physical availability of containers to support commodity trades, there is an array of transactional strategies that would help support containerized commodity exports. First, transactional issues related to international trade, including commodities, can be a notable impediment. Large amounts of capital are required for bulk transportation, while containerization is less cash intensive and the transactions are cleared faster. Sometimes, the impediment is the documentation of the transaction. For instance, letters of credit take 60 days to clear when exporting commodities in containers to foreign markets (e.g. to India). This involves a complete transactional cycle from securing credit, ordering, delivery (the longest segment) and then taking ownership of the shipment and selling to customers.

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The Containerization of Commodities: Integrating Inland Ports with Gateways and Corridors in Western Canada
Large and well capitalized corporations can readily deal with this trade requirements. Commodity importers in developing countries tend to be smaller and are less capitalized. When involved in commodity trades, the cash flow of smaller importers is further slowed down as their capital investment is frozen until they receive shipment delivery and sell it to their customers. Commodity trades have a lower transactional velocity than retail trades and are less desirable from a cash flow perspective.

A mitigating strategy concerns creating a spot market in the customers' country instead of a futures' market in the exporting country (Canada). The exporter takes the risk of forwarding the commodity shipment to the foreign market (at the port or inland port) and then sells the commodities to their customers using the facility as a clearinghouse. It results in a faster cash flow (clearing of letters of credit) for the customers and therefore more transactions and a higher velocity of commodity flows. Containerization facilitates this process since the load / trade units are smaller and shipments can be organized to arrive in a sequence matching the local demand. This can be effective when the demand is well known and the customers consistent in their purchases.

Another strategy concerns increasing the added value of commodities through a level of transformation that can be performed before they are loaded into export containers. Conventionally, commodities tended to be exported without much transformation. Added value is commodity specific and can involve milling (flours or splitting lentils), cleaning or transformation (e.g. making pasta). This could be a positive factor for containerization as it could lead to higher product density as well as higher cargo value and therefore, a better transport economics case.

The timeliness of commodity exports must be matched with the timeliness of container transportation. Agribusiness is known to be unreliable in terms of its schedule integrity because schedule integrity was seen as a secondary consideration in commodity chains, except for the “cold chain”. Most bulk products are transported in sequence implying long buffers, such as grain elevators, stockpiles, as well as the interchangeable character of loads. If a customer is not present to take ownership of a load at a designated time, the same load can be taken over by another customer, broken down in smaller loads or merged into a larger load. This is a fundamental characteristic of bulk cargo. For containerized commodities, however, even if the final delivery of the load is not bound to a high level of schedule integrity, the container in the transport chain is.

To ensure the efficiency of containerized commodity chains it is important to match facilities and equipment, both at the origin and the destination. An efficient stuffing process near a port or inland port should be matched with the same equipment and efficiency at the facility the container is bound to. Otherwise, from the perspective of a maritime shipping or container leasing company, the gains achieved at the export segment are lost in the import segment with the overall effect that their container assets remain inefficiently used. The export of commodities may thus require
partnerships with other inland ports or intermodal facilities to support efficiency along the whole transport chain. Matching should be considered as a comprehensive containerization strategy aiming at the establishment of a continuous commodity chain, including the repositioning of empty containers.

**Main Regulatory Concerns**

Most of the stakeholders indicated that the overall regulatory environment is positive in Western Canada, with limited obstacles for containerized commodity trades. Some regulatory concerns directly related to the containerization of commodities:

- The inconsistency of trucking regulations for the operation of trucks between provinces is impairing the efficiency of containerized commodities. While maritime shipping and rail have benefited from economies of scale (e.g. longer intermodal trains and double stacking), trucking has not been able to follow suit. Where possible, economies of scale for trucking must be promoted by providing a transport chain between British Columbia and Manitoba with consistent regulations concerning truck weights and dimensions (2 to three trailers). The possibility of heavier loads for drayage operations would be helpful in the operations of inland ports and the containerization of commodities as well.

- The expected abolition of the Canadian Wheat Board is causing companies involved in wheat trade, distribution and processing to reconsider their Canadian strategy. This could involve, for instance, moving closer to supply sources because wheat could be bought directly from smaller producers instead of the Wheat Board. The demise of the Wheat Board may redefine elements of Canadian agriculture, notably its distribution and marketing.

- Border crossing and cargo inspections will continue to cause delays for commodities. Food is likely to get a high level of inspection, as opposed to wood, minerals, parts and finished goods.

- Lobbying and competitive pressures from American West Coast ports over the perception of unfair competitive advantages Canadian ports may have in regard to transpacific trade are a new factor to be addressed. The U.S. Federal Maritime Commission (FMC) is investigating allegations that Canada unfairly subsidizes the diversion of cargo. This is a complex matter as the competitive advantages of Port Metro Vancouver and the Port of Prince Rupert are multifaceted, including shorter transpacific crossing times (particularly for Prince Rupert) and hinterland rail connections by CN and CP reaching deep into the American Midwest. The FMC is expected to deliver its findings to the U.S. Congress in 2012. If this allegation is judged to be accurate, this could involve a fee in the range of 140 USD per container imposed on containers entering the
United States through a Western Canadian port to cover the Harbor Maintenance Tax paid for cargo being imported through American ports.\textsuperscript{54}

Other regulatory concerns expressed during our research are not directly related to the containerization of commodities. They remain important to the operational efficiency of an inland port:

- The control (ownership) of land for development is a complex issue for inland port development. It is unclear if direct land ownership is associated with higher levels of attraction of freight distribution activities.
- Foreign trade zone status and duty deferral may be perceived as factors promoting import-based logistics, but the views are ambivalent. It was stated on several occasions that the existing Canadian regulatory framework is flexible enough to accommodate a variety of import related supply chain management strategies (e.g. duty deferral, light transformations, inspections, etc.).
- Open skies for freight would likely attract more air cargo companies at inland ports co-located with airport facilities (e.g. Winnipeg, Edmonton, Calgary) as air freight operators would be able to benefit from less congested airports and lower operational costs.

I. Conclusion and Recommendations

The containerization of commodities is essentially the development and expansion of a niche market brought by the container as a transport and supply chain management unit. The full scope of this niche market fluctuates according to the price of the respective commodities, the nature and extent of the demand and container shipping rates. All of these are commodity specific. What remains certain is that containerization will never replace the advantages of bulk shipping. That said, in specific trades a growing level of intermodal integration is occurring in Western Canada. The last decades have seen an increase in the containerization of commodities as container shipping rates remained relatively constant (or declined along several routes) while the price of most commodity groups have doubled or tripled. Containerization enables a better level of inventory management of commodities. Yet, the availability of containers is a recurring challenge since maritime shipping companies, as dominant managers of containerized assets, will allocate them where there are commercial opportunities to recoup the costs of having these containers circulating outside their shipping and port networks. Domestic repositioning costs remain high.

A growing level of intermodal integration is occurring in Western Canada, which reflects a trend across North America and elsewhere around the world. Recent performance negotiations between terminal operators and railway companies ensure that each partner along the transport chain provides a level of service with agreed parameters. Inland ports are likely to be the missing multiplying effect that would encourage maritime shipping companies to have a larger number of containerized assets moving inland. The fast growth of the containerization of commodities taking place in smaller locations such as Regina is indicative that inland ports can play an active role in their containerization. Recall, however, transloading near port terminal facilities has been a preferred strategy to cope with the challenges created by the availability of containers and cheaper transport rates. There are indications that some transloading activities can be effectively moved inland, particularly in Calgary and Edmonton where there is a good supply of domestic containers available. As this takes place, a more abundant pool of empty containers will be available at inland ports to support containerized commodity exports.

Western Canadian containerized commodity exports concern a very specific range of commodities with wood products (lumber and wood pulp) and specialty grains (canola and lentils) accounting for a dominant share of the volume. This range is expected to increase, mainly because containerization supports product and market diversification and load integrity. This growth potential is impaired however by an array of operational hurdles where many maritime shipping companies see rather limited advantages of having their containerized assets spending undue time in the hinterland.
prioritization of transpacific exports (from Asia) is without doubt constraining the availability of containers in the North American and Western Canadian hinterland.

Recommendations

Based upon an analysis of the array of challenges that inland ports are facing, the following recommendations appear suitable as strategies to help promote the containerization of commodities in the Western Canadian setting:

- The containerization of commodities should be clearly emphasized as a strategy to promote Western Canadian exports to existing and new markets. Promoting exports and promoting containerization is essentially the same thing. The existing scale and importance of containerized commodity exports appear ill-understood by stakeholders outside those directly involved (e.g. commodity exporters, rail companies, port authorities).

- The Asia Pacific Gateway and Corridor initiative helped identify and prioritize key strategic infrastructure projects for long distance freight distribution within Canada and North America. This process should continue with inland ports and logistics facilities as more prominent elements, including their role as export platforms.

- Inland metropolitan areas with intermodal rail terminals should be labeled as inland ports in the discourse so that stakeholders and the general public understand the importance the container and intermodal transportation play in the economic dynamism of Western Canada. A whole city can be considered as a terminal servicing a region and therefore strategic to regional economic development. The inland port is one element of this functional entity and should thus be clearly integrated in municipal, regional and provincial development plans as well as their marketing strategies.

- The intermodal interdependency between shipping lines, railways, inland ports and trucking companies must be clearly understood. Each transportation component is a customer of the other. In spite of intermodalism being a clear concept for the freight distribution industry, many stakeholders, such as local and regional governments, tend to see transport modes as completely separate.

- The schedule integrity of commodity transportation must match the schedule integrity of container transportation. Otherwise, schedule integrity mismatches will impair the value derived from containerization of commodities.

- Co-location is an effective value proposition for the development of inland ports to improve the cargo volume handled, as well as the opportunities for cargo rotation between containerized imports and exports. It also represents a unique opportunity to have the numerous stakeholders involved in inland freight distribution (e.g. shippers, maritime shipping companies, railways, trucking companies, beneficial cargo owners) better coordinate their operations. This
does not undermine the value proposition of “near-location” projects where various real estate developers provide affordable land and infrastructure to locate freight distribution activities. Co-location and near-location both fit specific customer requirements niches.

- While intermodal terminals and logistics zones can function effectively as an inland port without a governance structure (e.g. Calgary), the promotion of the interests of public and commercial stakeholders often leads to its establishment. Many inland ports were developed as public entities (crown corporations) to foster public infrastructure investments. As inland ports become operational entities facing a growing level of intermodal and drayage traffic, the move towards the landlord Port Authority model appears logical to effectively and independently manage infrastructure and land use developments.

- The ongoing promotion of infrastructure investment at inland ports is a priority as traffic growth is taxing local and regional road infrastructure. A growing share of commodities being hauled by truck to the inland port would involve greater volumes of traffic and heavier loads on regional roads. An effective strategy supporting the containerization of commodities must thus insure the capabilities to bring heavy loads at inland ports.

- The setting of consistent drayage chains across Western Canada is a priority with common truck weight and length limits. It would enable long distance trucking companies to better achieve economies of scale and correspondingly extend the market reach of inland ports. This issue is mostly an inter-provincial problem that could be supplanted by federal regulation. By stating that specific long distance road corridors (e.g. the trans-Canadian highway) are of national interest and significance in supporting the economic well-being of the country, the Federal government could implement consistent trucking standards along these corridors. Inland ports should be strategic nodes within this drayage system, which would promote the complementarity between road and rail.

- Since a large share of maritime container assets are owned by shipping lines, these assets are managed in view to maximize their own revenue. Shipping lines are quite willing to consider additional market development opportunities that the containerization of commodities represents, but it has to involve a profitable usage level of their container assets. This requires a concerted effort between shipping lines, railways, inland ports, importers and exporters so that the use and repositioning of containers is as efficient as possible. For regional freight markets, the inland port can play a crucial role as a coordinator.

- Performing added value operations on commodities at inland ports would enhance their containerization, particularly if their value / weight ratio is improved. The deregulation of the Canadian Wheat Board would trigger added value activities closer to the source as grain traders would be able to purchase
grain directly from the producers. They would be incentivized to optimize their commodity supply chains in which inland ports will be an important element.

- The provision of container depots for maritime shipping companies at convenient locations within inland ports should be considered as part of the services. Railways are unwilling to have their yard perform a storage function outside specified dwell times. Cleaning facilities are also fundamental due to the preparation of containers to accommodate stuffing. Inland ports could provide a storage facility that includes cleaning services with free or very low dwell time charges as a (temporary) strategy to promote exports. Although low dwell charges are a limited incentive, their combination with fast turnaround times would make the value proposition more attractive. Drayage to and from the terminal could also be part of the service. Still, the impacts of such a proposition on the availability on containers inland are yet to be assessed.

- The setting of local or regional container pools at inland ports would be an intermediary measure to cope with the shortage of containers inland. This could be done in collaboration with shipping lines, container leasing companies or through an own account company managed by the inland port. Containers (20 footers) could be purchased and made available for exporters if they use the inland port as a loading facility. Once the commodities are exported, it would be possible to find a backhaul movement from the purchaser’s country to the inland port. This may encourage information sharing alliances between the customers of the inland port to see if cargo rotation opportunities could be found between importers and exporters. Once a business case of positioning container assets at an inland port has clearly been demonstrated to shipping lines, local pools would play a lesser role.

- Inland ports should be actively involved in pairing with inland ports or port-centric logistics zones in other countries, particularly Asia. Through the establishment of complementarities, supply and transport chains could be firmly established between suppliers and customers on both sides, in which commodities would play an active role. The ultimate goal is to establish a continuous containerized commodity chain from the stuffing to the de-stuffing location, including the repositioning of empty containers.

- Trade financing is an issue that could be used to leverage the commodity trade, particularly for developing countries. The commodity exporter and/or the inland port could finance the transaction (a risk factor), which could be cleared at the paired inland port facility. Commodity purchasers would benefit from a faster cash flow (clearing of letters of credit) and therefore more transactions could be realized with the same capital investment and corresponding higher velocity of freight. Containerization facilitates this process since the load / trade units are smaller. Also, guarantees for longer export contracts could help the
The containerization of commodities since shipping companies are reluctant to frequently renegotiate agreements.

These recommendations are based on an introductory and exploratory analysis of a sector (containerized commodities) and commercial ventures (inland ports) that up to the early 21st century were not prevalent in Western Canada. This sector and inland ports have surged as opportunities have arisen over the last decade. The consideration and operationalization of these opportunities as they relate to specific inland ports will require ongoing analysis by local stakeholders in light of the factors discussed in this paper.
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