Australian and Canadian Imports and Exports: Trade and Transportation

Elizabeth Barber
University of New South Wales
Australian Defence Force Academy
Canberra, ACT.,
AUSTRALIA
e.barber@adfa.edu.au
Ph: 61 2 6268 8843

Paul D. Larson
CN Professor of Supply Chain Management
Director, Transport Institute
University of Manitoba
Winnipeg,
CANADA
larson@cc.unmanitoba.ca
Ph: 1-204-474-6054

Introduction

This paper compares and contrasts a key import and export commodity from Australia and Canada in an endeavour to study similarities in infrastructure requirements, choke points and the importance of transportation flows from origin to destination. The main emphasis will be given to the comparison of home nation transport flows from the port of entry to consumption destination in the case of imports and from the point of origin to export port in the case of exports.

Australia and Canada have many similarities relating to transportation. They gained independence from Great Britain at about the same time (1867 for Canada and 1901 for Australia). Both countries are situated on a large area, with a relatively low population density. There are approximately 2.8 Australians per square kilometer and 3.3 Canadians per sq. km whereas in contrast there are about 31.3 Americans per sq. km. Both Australian and Canadian populations locate towards urban centres. Australia's largest proportion of population resides in the east coast cities of Melbourne, Sydney and Brisbane. Canada's three primary urban areas are the cities of Vancouver on the west coast, along with Toronto and Montreal in the eastern part of the country.

Australia and Canada are similar in terms of gross domestic product (GDP) per capita, at $39,300 and $40,200 respectively. Further, the two countries enjoy reasonable trade balances (exports less imports). Canada recently reported a modest annual surplus of $25.1 billion, while Australia experienced a deficit of $8.3 billion. Both countries are also among the UN (2007) best places to live, with Australia ranked third and Canada fourth.

One of Australia's main exports is coal and Canada is also a major exporter of energy including coal. A key Australian import is container trade. Its physical flow is dominated by two key stevedoring competitors that have extended their distribution control over the ports, container terminals and land transport on both road and rail. Likewise Canadian import flow is dominated by containerized freight.

While many Canadian exports are moved by surface modes (road, rail or pipeline) to destinations in the United States, all Australian exports move off the island by air or water.

This paper is our first step toward understanding the transportation flows and supply chains supporting movement of exports from and imports to these two countries. Our ultimate purpose is to identify opportunities for supply chain managers and transportation policy makers from Australia and Canada to learn from each other in terms of the unique and common challenges they face. Thus, the paper concludes with a research agenda, an outline of ideas for further consideration.

Australian Energy Exports: Coal to China

The Australian minerals and energy industry is a leading user of transport and logistic services. The major mineral exports are coal, iron ore and liquefied natural gas (LNG) with over 78,195 kt of iron ore exported in the March quarter 2009; 4 gigalitres of oil valued at $1.6 billion exported, and LNG exports valued at $2.5 billion in the same period. (ABARE, 2009)

Australia is the largest exporter of black coal in the world. The two areas in Australia that have huge coal resources are Queensland and New South Wales. The majority of the coal mines are located less than 300 km from the ports with many of the coal fields located within 100 km of their export port. Rail transport is used to transport the coal from the mines to the bulk export ports. This means that short transit times can provide a high degree of responsiveness to changes in demand and to meet shipping schedules rapidly.

Coal production levels and export (saleable) coal is shown in Table One below.

Table 1. Coal Production by Mining Method and State per million tonnes

Mining Method/State	**Black Coal, Raw**		**Black Coal, Saleable**	
	2006-7	**2007-8**	**2006-7**	**2007-8**
Underground	93.7	104.8	73.6	83.8
Open Cut	320.7	316.4	251.6	243.0
Total	414.4	421.2	325.2	326.8
NSW	169.7	177.0	130.9	135.0
QLD	243.1	233.2	184.1	180.9
SA	3.6	3.8	3.6	3.8
WA	6.2	6.4	6.1	6.4
TAS	0.8	0.6	0.4	0.4
Total AUS	414.4	421.2	325.2	326.8

Source: Australian Mineral Statistics, December Quarter 2008 ABARE.

The Queensland's coal rail network is owned and operated by the Queensland State Government Corporation. The rail infrastructure is solely owned by Queensland Railways (QR). While rail freight services are open to third party competition, no 3PLs have accessed this option to date. The coal lines are known as the Goonyella Coal system which is a narrow gauge (3 ft 6in or 1,067 mm) electrified (25 kV – 50 Hz) service. This system services 24 mines and currently operated under a demand-pull model with the haulages being called forth from the port authorities based on shipping schedules. (www.qrnetwork.com.au/networks/coal/Goonyella-system.aspx Goonyella system)

During 2008, QR hauled 184 million metric tons of coal. It operated 550 coal services a week from 56 mines. The operating trains carry between 2100 and 8600 net tones of coal. There are balloon loops and rapid overhead loading bins at all port terminals ensuring efficient loadings. Coal trains in Australia are among the longest in the world with 6 locomotives and 148 wagons, mostly open topped. On tracks in central Queensland, trains are typically two kilometers in length and carry approximately 8,500 tonnes per train.

New South Wales major coal production occurs in the Hunter Valley just north of Sydney. It is serviced by the NSW rail infrastructure which is leased by the Australian Rail and Track Corporation (ATRC). The sixty year lease includes the NSW interstate track and the Hunter Valley rail coal freight corridors. Pacific National is the primary coal haulage operator. (International Railway Journal, 2004)

Australia wide the coal industry is serviced by nine coal terminals at seven ports, all along the east coast. Port ownership is a combination of public and private interests. The combined annual loading capacity is currently 270.5 Mt. There are six coal terminals at four deepwater ports in Queensland with the Dalrymple Bay, Hay Point and RG Tanna terminals handling around 85 percent of all export coal.

The New South Wales coal export ports are located at Newcastle, north of Sydney and Wollongong, south of Sydney. The Newcastle port is operated by the Port Waratah Coal Services Limited (PWCS) Company. It operates the world's largest and most efficient coal handling port. Its two ports, Carrington and Koorangan handle all the export coal from the Hunter Valley coal fields. The Wollongong port is operated by the Port Kembla Coal Terminal. This port exports all the coal from the southern and western coalfields of New South Wales.

The RG Tanna port located at Gladstone is unique in Australia as it is the only Australian port authority that operates as a supervisor of the port and also owns and operates the cargo handling facilities in the port including the bulk coal loading facilities at RG Tanna Coal Terminal. It has a natural deepwater harbour, protected by outer islands. The four Clinton wharves are for the exclusive use of coal exports. They can berth vessels of a maximum size of 220,000 tonnes and 315 metres overall length. The RG Tanna Coal port is a multi-user berth exporting coal from the mines in the central Queensland Basin. All coal is received by rail on a 24/7 operational throughput. In 2006-7 it handled 45 Mtpa but has a throughput capacity of 70+ Mtpa. Mines served were: Blackwater, Ensham, Moura, Gregory, Kestrel, Jellinbah, Curragh, Yarrabee, Oaky Creek, Cook, Rolleston, Minerva, and Baralaba (Central Queensland Ports Authority, Resource Booklet, 2006).

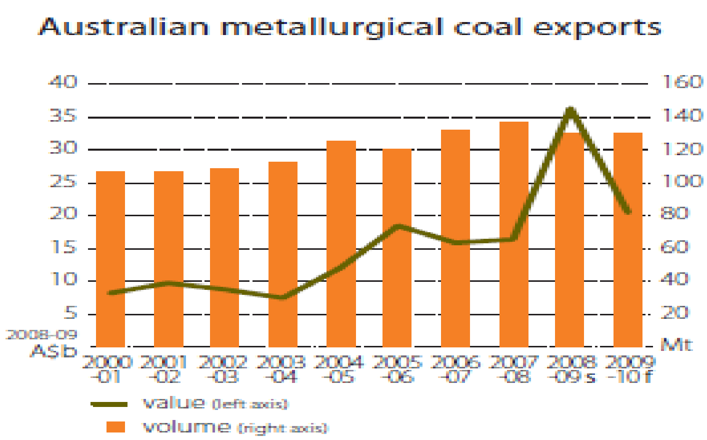
The distance from the mines vary but the nearest is Moura about 189 km away and the most distant is Oaky Creek at 394 km. There are three unloading stations allowing three trains to unload simultaneously at 6,000 tph. The rail gauge is 1,067 mm. Linked to this is stock piling facilities via conveyor belts. The average train to enter the authority along the Moura line is 1.7 km in length and has a payload of 4,200 tonnes, although the

Blackwater line produced an average payload of 7,150 tonnes per train in 2006. All wagons are bottom dump wagons to hoppers under track. The rail balloon loop at the TG Tanna port is 3 x 3.3 km and can stockpile at a rate of 3 x 6,000 tph. The annual receival capacity is 58 Mtpa. The conveyor belt width is 1,800 mm with a receival speed of 5.1 metres/second. There are five lines of overhead conveyor belts operating from the transfer point from the unloading stations. These conveyors which are 18 metres high discharge coal via traveling trippers, from either or both sides onto stockpiles at a rate of 6,000 tph. This discharge rate is equal to the uploading rate.

The stockpile total capacity at this port is 5.95 Mt which means that the total number of stockpiles is 21 given the current area of the port facilities (Central Queensland Port Authority, 2006 Resource Booklet). The ship loading belts that lead from underground coal pits to stockpiles can blend from a maximum of four different coal stock pile varieties at any one time. The flow rate is computerized to schyronise with the ship loading conveyors to the required blend rate. This is a value adding function blending coal to match demand at the export port rather than further up the supply chain.

The export volumes have dropped during the recent recessional period of 2009 with Figure 1 showing the total export coal tonnages from 2000.

Figure1. Australian Exports Coal 2000 - 2009



Source: Minerals Council of Australia, The Australian Minerals Industry and Australian Economy, Fact Sheet, July, 2009

Issues in the Australian Energy Export Coal Supply Chains

A key issue concerns the perceived congestion on the rail tracks in Queensland. Rail transport of coal to the ports is seen as a choke point in the total supply chain. The total cycle time comprises mining, stockpiling, transshipment by rail to the port, stockpiling and then conveyor belt transportation to the bulk ship carriers. In 2004 the coal mine producers expressed disquiet regarding the projected capacity of the transport systems in view of the potential future coal export demands. A study was commissioned to identify the supply chain constraints, recommend throughput targets and future requirements in infrastructure needs. It was found that inadequate rolling stock was causing problems, and that rail and port contracted tonnages had not been achieved. (Goonyella Coal Chain Capacity Review, 2007)

The study found that the large number of participants and stakeholders associated with transportation was causing complexities and lack of decision making. Although the coal producers in NSW and Queensland are fiercely competitive on coal grades, prices and deliveries, they have a common interest to gain maximum performance from the supply chains delivering coal to customers' ships. (King, S., 2008, The ACCC's role in coal chain logistics, CEDA Conference) It was recommended that transparency of information was vital to improve performance, and a central coordination role by one of the main participants should take on smoothing the flows of coal to meet shipping schedules. The resolution seems to have changed over the years. Due to the current recession, causing the Queensland State government to experience massive deficits, it has been announced in Parliament by the QLD Premier on the 2nd June, 2009 (QLD Parliamentary Papers, June, 2009) that a number of the coal export ports will be sold and privatization of the railways operations and rolling stock should occur. By July, 2009 the sell-off of coal rail track and some coal ports was retracted. (Courier Mail, July, 29, 2009) At the time of writing it is perceived that the political decision making on these issues is still volatile.

Canadian Energy Exports: Oil and Gas to the United States

According to the Canadian Association of Petroleum Producers (CAPP), Canada is the world's third largest producer of natural gas, the fifth largest energy producer, and the seventh largest producer of crude oil (see http://www.capp.ca).

Canadian oil production comes primarily from three sources: the Western Canada Sedimentary Basin (WCSB); oil sands in northern Alberta; and offshore fields. Canada had oil reserves of 27.7 billion barrels at the end of 2007, not counting the Oil Sands. In 2007, Canada produced 3,308.6 thousand barrels of crude oil per day and consumed only 2,302.8 thousand barrels a day. The bulk of Canada's reserves are oil sands deposits in Alberta, with end of 2007 oil reserves of 152.2 billion barrels. For more details, see http://www.mbendi.com/indy/oilg/am/cn/p0005.htm.

Figure 2. Canadian Exports of Oil and Gas: Top Ten Countries
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Source: http://www.ic.gc.ca

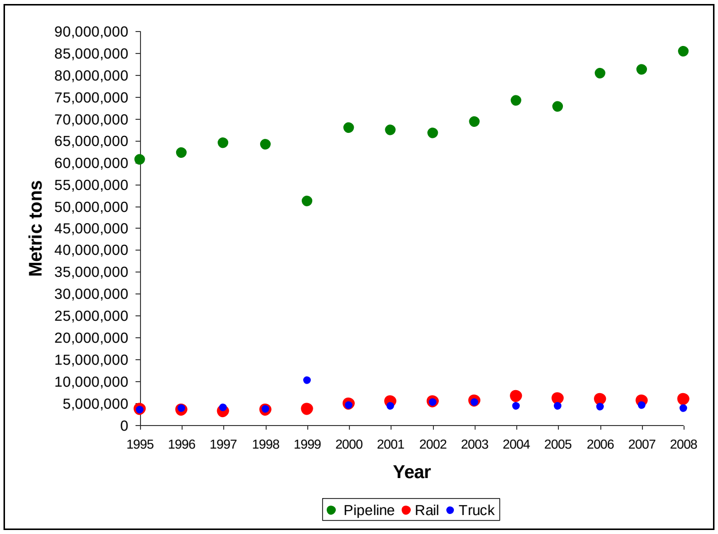
Figure 2 shows how Canadian oil and gas exports are dominated by a single customer: the USA. At 2,583,000 barrels a day, Canada was the largest exporter of crude oil and petroleum products to the United States in 2008. The other top five exporters, all with export volume of more than 1 million barrels per day, were: Saudi Arabia, Mexico, Venezuela and Nigeria. In terms of natural gas alone approximately 90 % of all product imported into the United States comes from Canada (see http://www.eia.doe.gov).

Canada is also one of the world's largest producers and exporters of natural gas. In 2007, Canada produced 183.7 billion cubic metres (cm), consumed 93.9 billion cm and had gas reserves of 1.6 trillion cm http://www.mbendi.com/indy/oilg/am/cn/p0005.htm). Canada's natural gas production is concentrated in the WCSB, largely in Alberta. TransCanada Pipelines is the largest operator of natural gas pipelines in Canada, with a network spanning 25,600 miles.

The Oil and Gas supply chain to the USA from Western Canada sees oil transported by pipelines from the production facility to refineries where it is upgraded into products like gasoline, heating oil and jet fuel. Offshore Newfoundland and Labrador, which accounts for about 13 per cent of Canada's crude oil production, transports crude oil to markets by tanker (http://www.capp.ca).

Canada has an extensive pipeline system which moves western Canadian oil. The two major oil pipeline operators are Enbridge Pipelines and Kinder Morgan Canada. Enbridge has a 9,000-mile network of pipelines and terminals, delivering oil from Edmonton to eastern Canada and the U.S. Great Lakes region, while Kinder Morgan operates the Trans Mountain Pipe Line (TMPL), which delivers oil mainly from Alberta west to refineries and terminals in the Vancouver area. For more details, see http://www.mbendi.com/indy/oilg/am/cn/p0005.htm.

Figure 3. Canadian Exports of Oil and Gas to USA by Transport Mode



Source: http://www.bts.gov

As Figure 3 shows, the bulk of Canadian oil and gas exports to the USA are moved by pipeline. Reliance on pipeline transportation follows from a notable difference between Australia and Canada—Canada shares a long land border with its largest customer.

Chima (2007) provides a discussion of business/economic issues in the oil and gas supply chain, broadly mapped as follows: Exploration → Production → Refining → Marketing → Consumer. Pipeline transportation, as briefly described above, occurs primarily between the production and refining stages.

Issues in the Canadian Export Oil and Gas Supply Chain:

Security and sustainability are two of the critical issues in energy supply chains. The challenges in energy security include the following: price volatility; steadily rising demand, coupled with peaking supply and under-investment in infrastructure; disruption of supply caused by political intervention, armed conflicts or natural disasters; lack of transparency and stability in regulatory, judicial and/or taxation frameworks; and ever more unsustainable production/consumption of energy (http://www.international.gc.ca).

While there is ongoing debate about "peak oil," i.e. global oil production soon peaking, reserves are considered sufficient to meet oil and natural gas needs to 2030, according to the International Energy Agency (IEA) World Energy Outlook 2006. However, the IEA is concerned future energy trends may be unsustainable in terms of resource availability and environmental impact, including greenhouse gas emissions. These concerns are compounded by the economic impacts of continued high oil prices. For more on peak oil, see http://lifeaftertheoilcrash.net/.

Harper and Stewart-St. Arnault (2008) discuss the issue of greenhouse gas (GHG) emissions during oil production. The production of oil sands oil requires considerable burning of natural gas and results in GHG emissions that are greater than in production of oil from other sources.

In the United States, federal and state legislation could render oil from the Canadian Oil Sands less attractive vis-à-vis global competitors. For instance, California's low carbon fuel standard measures the amount of greenhouse gases needed to produce fuel, putting use of heavy crude oil at competitive disadvantage vis-à-vis conventional light crude or alternative fuels. This compels U.S. refiners to buy less Canadian oil—particularly oil from the Oil Sands—and import more oil from the Middle East.

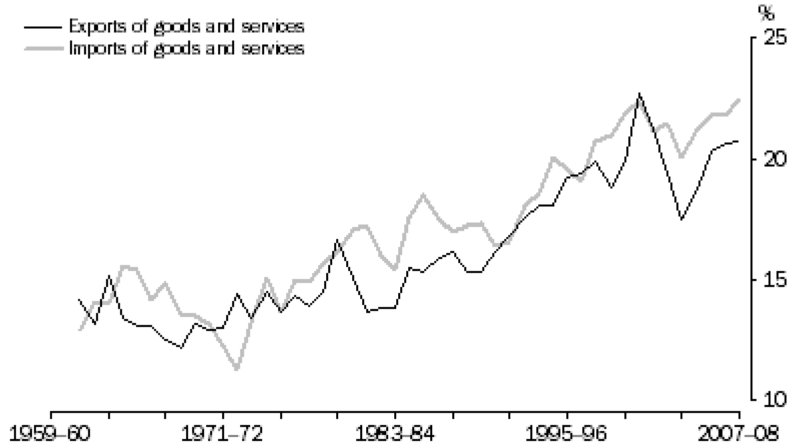
The Athabasca Oil Sands deposit, in northern Alberta, is one of largest in the world. There are additional sizable oil sands deposits on Melville Island in the Canadian Arctic. Oil sands contain deposits of bitumen, which is heavy viscous crude oil. Two methods are used to extract bitumen from the ground: open pit mining and *in situ* (Latin for "in place"). Open pit mining is effective for extracting oil sands deposits near the surface. However, about 80 percent of Canada's oil sands deposits are too deep for open pit mining. The *in situ* method reaches these deep deposits, using steam to separate bitumen from surrounding sands and lift it to collection pools near the surface. Once extracted, producers add lighter hydrocarbons to the bitumen to allow it to flow through pipelines. Upgraders then process the bitumen into "synthetic crude." Other environmental issues linked to oil sands production include massive use of water and alteration of the Boreal forest (http://en.wikipedia.org/wiki/Athabasca_Oil_Sands).

Australian Imports: Container Traffic from Asia

Since 1960 Australia has been a net importer of goods and services. Figure 3 shows the ratios of exports and imports of goods and services to GDP in current prices since 1959-60. Import and export ratios were 22.5 and 20.7 percent, respectively, for 2007-08.

The imbalance, i.e. imports exceeding exports, has increased since 2000-01 with imports increasing 91.8 percent compared with only a 15 percent increase in volume of exports. Slower growth in exports was mainly due to weak grain exports. Nevertheless, prices received for exports grew faster than prices paid for imports since 2000. The majority of the import trade comes in the form of container traffic. Australia's largest suppliers of imports are Asian. Figure 4 shows this imbalance of trade.

Figure 4. Exports and Imports Current Prices Relative to GDP 1959-60 to 2007-08



Source: Bureau of Infrastructure, Transport and Regional Economics, Waterline, December, 2008.

Container ports are located in the capital cities of Brisbane, Sydney and Melbourne on the east coast. During 2007-08 approximately 5 million TEUs were transferred through these three ports. For comparison the total container movement in Hong Kong was approximately 24.7 million TEUs and through Singapore was approximately 23.5 million TEUs. Port container traffic measures the flow of containers from land to sea transport modes and vice versa in twenty-foot equivalent units (TEUs).

At present there are two stevedoring companies operating in all three ports. DP World is a part of a larger group of companies under the holding company, Dubai World. In 2007 DP World handled more than 43 million TEUs globally. It has a global capacity of more than 54 million TEUs which is expected to increase due to expansions in India, China and the Middle East. DP World also operates P&O Maritime services world wide. In Australia, DP World has strong sea linkages and their land transport company P&O Trans has the largest market share of truck movements with an estimated 15 percent of container movements to and from the port.

Table 2. Container Traffic through Sydney, Melbourne and Brisbane Ports

Port	2007/2008 TEUs (TEU is defined as a twenty foot equivalent container unit.)								
	Imports			Exports			Total		
	Full	Empty	Total	Full	Empty	Total	Full	Empty	Total
Melbourne Port Corp.	1,050,445	98,724	1,149,169	727,037	380,104	1,107,141	1,777,482	478,828	2,256,310
Sydney Ports Corp.	887,562	19,020	906,582	385,092	486,768	871,860	1,272,654	505,788	1,778,442
Port of Brisbane Corporation	413,391	65,781	479,172	255,711	207,833	463,544	669,102	273,614	942,716

Source: http://www.portsaustralia.com.au/tradestats/?id=5

Patrick Stevedoring Company is closely linked to land transport rail and road services. Patrick is a subsidiary of Asciano Limited, a publicly listed company. It is one of Australia's largest companies focused on transport infrastructure, including ports and rail. Patrick was established as a waterfront company by a Captain James Patrick in 1919 and since then has undergone a number of mergers and takeovers. The most recent change occurred in 2005 when Tolls (a transport company) was successful in its hostile takeover bid. Toll gained ownership of Patrick's Container Terminal operations, PortLink and Port Services businesses and stevedoring operations, as well as 50 percent of Pacific National railway interests. The conglomerate was restructured into two public companies with Asciano incorporating Patrick waterfront acquisitions and services, including all container ports and operations and stevedoring businesses. It also took 100 percent ownership of the Pacific National rail network.

A third stevedoring company to operate the additional terminal facilities being built under the current expansion project of Port Botany, Sydney has yet to be determined. Container ships account for 75 percent of all shipping in the Ports of Sydney. Approximately 1,350 container ships visited Port Botany during 2007-08.

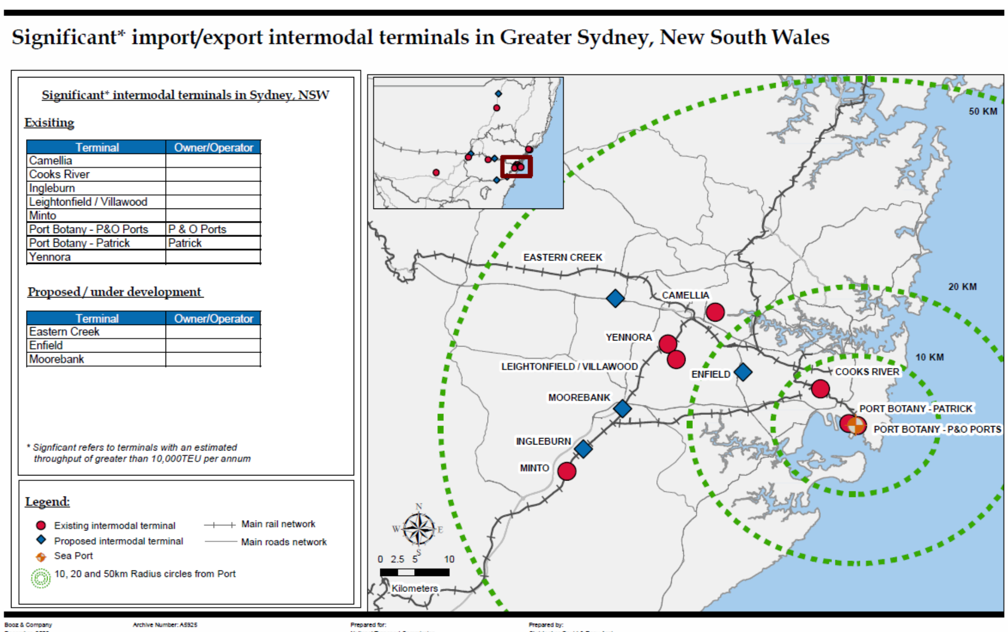
The land transport section of this import flow is typically short and mainly restricted to the local urban areas. In Melbourne approximately 70 percent of import container load destinations were to the outer suburbs, 11 percent of the container ultimate destinations were to the inner suburbs, and the remainder was to destinations in regional Victoria and southern New South Wales. The majority of import containers were unloaded in the outer industrial suburbs located less than 40 km from the port. Approximately 80 percent of these total movements were transported by road direct to the door of the destination with rail taking the remaining 20 percent into an inter-modal chain.

In Sydney a similar breakdown occurs. NSW Freight Council research showed that 70 percent of full imported containers and 34per cent of full export container movements originated from/to areas in the central west, south west and west in the metropolitan of

Sydney. Due to heavy congestion on the roads in Sydney, the Sydney Ports Corporation purchased the Enfield freight railway yards from FreightCorp, a private company, in 2003. It is a 60 hectare site located 18 km on a dedicated freight rail line from Port Botany. The Corporation plans to develop an Inter-modal Logistics Centre (ILC) which would service a target of 40 percent of the containers by rail by 2011. The aim is to ease the flow of containers through the ports and into western Sydney suburban warehousing sites as well as to ease congestion on the city's roads. It will have an inter-modal terminal capacity for 300,000 TEUs per annum.

The rail infrastructure is owned by the NSW Government's entity, RailCorp. Recently the NSW and Commonwealth governments agreed to transfer the management of the Sydney metropolitan freight rail network from RailCorp to the Australian Rail Track Corporation (ARTC). This transfer of the long term lease will be finalized during the 2008-09 financial year. Subsequently the ARTC will manage the rail corridors for all container traffic to Port Botany. The ARTC will manage an extremely competitive rail usage service. Currently there are four train operators servicing Port Botany with the aligned Patrick Logistics Services being a major operator. Figure 5 below shows inter-modal terminals in urban Sydney and the short distance by rail from the port to the Enfield site.

Figure 5. Intermodal terminal flows in Greater Sydney Area



Over 1.5 million TEUs flowed through the Sydney container ports during the year 2008-09. The total full container imports for the year to April 2008-09 reached 748,600 TEUs. The leading importing regions were dominated by East Asia (44 percent) and South East Asia (15 percent), making Asian container imports nearly 60 percent of all trade. Europe accounted for 17 percent of imported full container loads. There has been a slight but

continual decline in the import of full containers during the year, with April experiencing a decline of 6.3 percent representing 138,600 TEUs (Sydney Ports Corporation, Trade Bulletin, April 2009). The majority of imported products comprised machinery and transport equipment, miscellaneous manufacturers and chemical products, representing 56 percent of all containerized goods imported during 2008-09 through Sydney ports (http://www.portsaustralia.com.au/tradestats/?id=20).

A flow on effect of imported container loads is the export of empty containers, typically to their point of origin. The Australian dollar has decreased in value compared with the world currencies which has contributed to Australian exports competitiveness, which in turn was linked to a decrease in the export of empty containers. The empty container exports will increase when the movements in full container imports is lower than the full container exports. In 2007-08, 51 percent of the total TEUs traded through Port Botany was imported of which 98 percent were full. Only 44 percent of export containers were full which represented the strong consumer market in Australia and results in the repositioning of empty containers to global exporting markets. There was an 11 percent increase in full importing containers during the 2007-08 year (Sydney Ports Corporation, Trade Statistics, 2007-08).

Issues in the Australian Import Container Freight Supply Chains

Duopoly and congestion are the two critical issues in the container supply chains. There is congestion at all ports mainly on the queues of trucks waiting outside the gates. The turnaround times in the terminal are equal to world best practice but the congested roads and waiting time make this section of the flow extremely slow. Government and public authorities have continually attempted to streamline the flows to little avail yet it seems in this case study that they are the dominant player which can influence very strongly the land transport section of the chain.

The main congestion points seem to be access to and from the container terminals. In Sydney the average truck turnaround time at the Port Botany container terminals is 45-55 minutes from gate to gate. Sydney Ports Corporation introduced a port traffic management framework for all port users. It provided TruckCam images for port users to deliver real time information and monitor traffic conditions to the container terminals, road carriers and freight forwarders about truck movements on the peripheral and outside the immediate port facilities. Truck queuing for entry is very congested.

From July, 2006 the NSW government introduced the Higher Mass Limit (HML) legislation allowing eligible road carriers to operate on Sydney roads at increased mass limits above the statutory limits.

Table 3 Higher Mass Load Limits for NSW Roads

Road vehicle configuration	Standard Gross Mass Limit	Higher Mass Limit	Payload Increase
19 metre (6 axle) semi trailer	42.5 tonnes	45.5tonnes	10%
25 metre (9axle) B-double	62.5 tonnes	68 tonnes	13%

Source: Constructed from Sydney Port Corporation, *Logistics Review*, 2007-08, October, 2008, p. 12.

The Brisbane and Melbourne container flows face similar congestions. The various State governments have a powerful influence over the structure of the land transport flows. The government recognizes the power of the duopoly of the stevedoring industries in Australia. Although there are concerns about vertical integration and market dominance the road task in Sydney is handled by approximately 250 trucks ranging from single truck owner-operators to large national freight companies. Other than P&O Trans (owned by DP World) all other carriers have fewer than 5 percent of the market share. Melbourne and Brisbane road transport is similarly competitive.

The NSW Government identified the use of a Peak Period Pricing mechanism as a means to encourage 24/7 operations for stevedores, road carriers and empty container movements. The Sydney Ports Corporation will charge $160 per truck entering between the peak times of 5am to 1pm; $80 for arrivals between 1pm and 9pm and a $20 credit for arrivals during the weekends. Melbourne supply chains flows are different in a number of ways; firstly the road transport industry is much less fragmented with 80 percent of the transfers being done by only 20 percent of the carriers. Secondly, Melbourne's extensive freeway networks provide immediate access into and out of the port precinct, resulting in much less congestion and quick dispersal. A 24/7 approach is common with major receival warehouses changing operating hours to fit in with shipping schedules more smoothly. (Australasian Freight Logistics, July/August, 2009, pp. 10-11.)

The equality of market share between the two main stevedoring companies at all three of the eastern ports has led to innovative practices, competitive pricing and competitive advantages arising from 'locked in' partners, alliances and preferential contracts with customers.

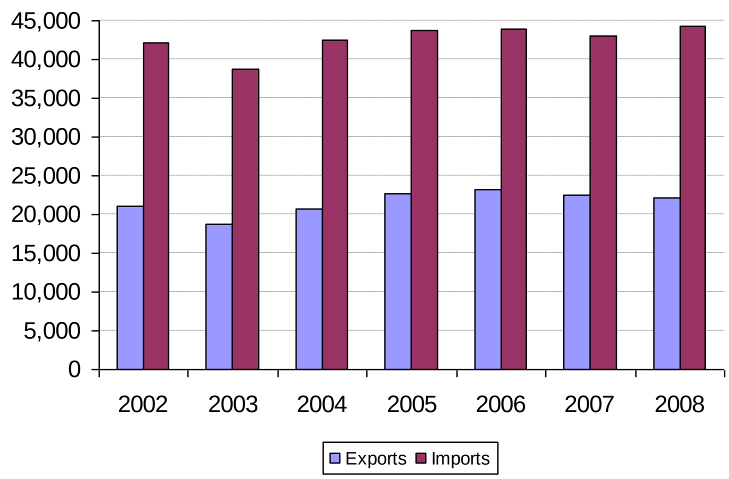
Canadian Imports: Computers and Peripherals from China

Under the new North American Industry Classification System (NAICS), the Information and Communications Technologies (ICT) sector includes manufacturing of: computer and peripheral equipment (33411); telephone apparatus (33421); radio and television broadcasting and wireless communications equipment (33422); audio and video equipment (33431); semiconductor and other electronic components (33441); and communication and energy wire and cable (33592).

In 2008, Canadian exports of ICT goods declined 2.0 percent to $22.1 billion, while total exports of goods grew 7.3 percent. ICT exports in 2008 were strongly affected by a drop of $1.7 billion in exports of wired communications equipment. If wired communications equipment is excluded, ICT exports actually grew by $1.2 billion or 7.1 percent in 2008. Some of the product groups that increased are: electronic components and wireless communications equipment.

Canadian ICT imports rose 2.6 percent to reach $44.2 billion. Imports of wired and wireless communications equipment grew by 14.5 percent and 11.0 percent, respectively. Computer and peripheral equipment represented 29 percent of ICT imports in 2008.

Figure 6. Canadian Exports and Imports of ICT Goods ($ million)



Canada's trade deficit in ICT goods increased 7.7 percent in 2008, to reach $22.1 billion. Computer and peripheral equipment alone accounted for 41 percent of this trade deficit, followed by audio/video equipment (24 percent) and electronic components (17 percent). As shown in Figure 6, Canada continues to endure a trade deficit (import balance) in ICT goods of about $20 billion per year (Industry Canada, http://www.ic.gc.ca).

Due to their relatively high $ value per kilogram, computers and peripherals tend to be shipped from China to Canada via airfreight, and then moved into stores, businesses and government agencies by truck.

Issues in the Canadian Import Container Freight Supply Chains

As in the Australian case, the issue of traffic congestion at the ports and in the cities is in play, particularly on the west coast. A new port at Prince Rupert, north of Vancouver, has opened partly to alleviate congestion. There has also been considerable discussion about developing inland ports, from Edmonton to Winnipeg, to move inbound freight away from the ports for further processing, such as customs clearance and sorting.

Positioned at the *push-pull boundary* (Larson and Morris 2009), inland ports may also enable supply chain performance improvement, through postponement of assembly and/or movement of goods to market and centralization of inventories and other resources. An inland port is a logistics facility located away from the sea which supports movement and processing of freight by offering or enabling intermodal transportation services and other value-added logistics services, such as assembly, customs processing, promotion, labeling, packaging, sorting, inspection, etc.

Discussion

This initial step in our study of Australian and Canadian import and export supply chains has identified some interesting similarities and differences between the two countries. Both countries are major energy exporters, and large importers of containerized freight. While Australian imports typically travel short distances from the port to final customer, most Canadian imports travel long distances after arrival at the port. For instance, many goods arriving at the Port of Vancouver are transported thousands of kilometers across Canada to markets such as Winnipeg.

Traffic congestion at sea ports and container terminals is another common theme in Australian and Canadian international trade. In Australia, the response to congestion at container terminals includes peak-period pricing schemes to level out the traffic flow. There is also congestion centered on rail transportation of coal exports via rail. A recent report suggests that supply chain leadership may be the solution to this problem. The Canadian response to (west coast) port congestion is highlighted by development of a new port and container terminal, at Prince Rupert, British Columbia. There has also been considerable discussion about the possible role of inland ports in reducing congestion.

Future Research

This paper draws mostly on archival and secondary data describing certain elements of transportation and supply chains for prominent Australian and Canadian import/export product groups. Our intentions are to investigate these supply chains in much greater detail by collecting primary data.

The next step should involve case-based research focused on specific industry sectors, such as coal, oil and gas, and computers/peripherals. Cases would include interviews with selected industry participants and stakeholders, as well as archival and secondary data. Among the purposes of the interviews would be to facilitate creation of detailed supply chains maps, to identify supply chain bottlenecks and other unique challenges, to discover opportunities for greater supply chain integration, and to understand regulatory aspects and public policy implications of these important supply chains.

References

ABARE, Australian Mineral Statistics, December Quarter, 2008 and 2009, http://www.abareconomics.com/publications_html/energy/energy_09/energy_09.html

Anonymous, ARTC to Control all Australian interstate Track, International Railway Journal, January 2004.

Australasian Freight Logistics, July/August, 2009, pp10-11.

Bureau of Infrastructure, Transport and Regional Economics, Waterline, December, 2008.

Canadian Association of Petroleum Producers (CAPP), http://www.capp.ca.

Central Queensland Ports Authority, Resource Booklet, 2007.

Chima, Christopher M. (2007), "Supply-Chain Management Issues in the Oil and Gas Industry," *Journal of Business & Economics Research*, Vol. 5, No. 6, pp. 27-36.

Coal Services Pty. Limited, http://www.pwcs.com.au/pages/about/stats.php

Energy Information Administration (EIA), U.S. Department of Energy, http://www.eia.doe.gov.

Energy Security: A Canadian Perspective, http://www.international.gc.ca.

Goonyella Coal Chain Capacity Review, 2004, Queensland Government, p. 3.

Harper, Dufferin and Nikki Stewart-St. Arnault, "Section 526 of the U.S. Energy Independence and Security Act remains alive and well – effect on Alberta Oil Sands still unknown," http://www.blakes.com, November 3, 2008.

http://en.wikipedia.org/wiki/Athabasca_Oil_Sands.

www.qrnetwork.com.au

http://www.mbendi.com/indy/oilg/am/cn/p0005.htm, with statistics from the 2008 BP Statistical Energy Survey.

Industry Canada, http://www.ic.gc.ca.

King, S., 2009, The ACCC's role in coal chain logistics, CEDA Queensland Export Infrastructure Conference, 2008.

Larson, Paul D. and Matthew Morris (2009), "An Inland Port in a Storm," *Proceedings of the 44th Canadian Transportation Research Forum (CTRF) Annual Conference*, pp. 114-122; presented May 25 at Victoria.
Ports Australia, http://www.portsaustralia.com.au/tradestats/?id=5

Sydney Ports Corporation, Logistics Review, 2007-08, October, 2008, p. 12.

Sydney Ports Corporation, Trade Statistics, 2007-08.

Sydney Ports Corporation, Trade Bulletin, April, 2009.