

REFRIGERATED TRANSPORT TO MEXICO: COLD CHAIN OPPORTUNITIES AND CHALLENGES

Barry E. Prentice and Ron McLachlin,
Supply Chain Management, University of Manitoba

INTRODUCTION

The Mexican food import market is large, diverse and accessible. The Mexican demand for perishable food imports has grown rapidly with the introduction of supermarket food distribution systems. Most value-added food products require climate controlled transport and storage, which is referred to as the “cold chain”. A continuous cold chain is necessary to maintain product quality and extend shelf-life. Mexican supermarkets completed the critical link in the cold chain that enables \$300 million of Canadian value-added food products to be exported annually to this market.

Efficient logistics and transportation are critical to the competitiveness of Canadian food products in the Mexican import market. U.S. food suppliers to Mexico have a natural advantage based on their geographic proximity. Canadian food exporters face logistics costs associated with two border crossings. Goods destined for Mexico must either be cleared first at the U.S. Customs, or cross the United States in-bond before negotiating Mexican border customs and other inspections. Canadian food exporters require efficient logistics to compete with their American counterparts.

The purpose of this article is to provide an overview of the cold chain logistics serving Canadian food exporters to Mexico. The analysis draws upon a larger study with extensive fieldwork interviews of exporters, carriers, importers and intermediaries that are active in the refrigerated product movements to Mexico (Prentice and McLachlin,

2007). The analysis is based on a combination of grounded research (Locke, 2001; Strauss and Corbin, 1998) and case-based research (Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Yin, 2003). Grounded research methods use the constant comparison of data with emerging categories. Case-based methods are appropriate for situations in which (1) the research questions are explanatory (i.e., how? why?), (2) the researcher has no control over behavioural events, and (3) the focus of the research is on contemporary events, conditions that are met for this study. While either of these approaches may be used without the other, the two approaches work well together and are particularly appropriate for managerial research (Locke, 2001).

The next section presents a snapshot of the Canadian food exports to Mexico and the demand for refrigerated transport. Subsequently, the supply of refrigerated transport is considered in terms of modal choice and routes. This is followed by a narrative of cold chain challenges identified by the respondents. The conclusion points to some policy issues for consideration.

OVERVIEW OF CANADA'S FOOD EXPORTS TO MEXICO

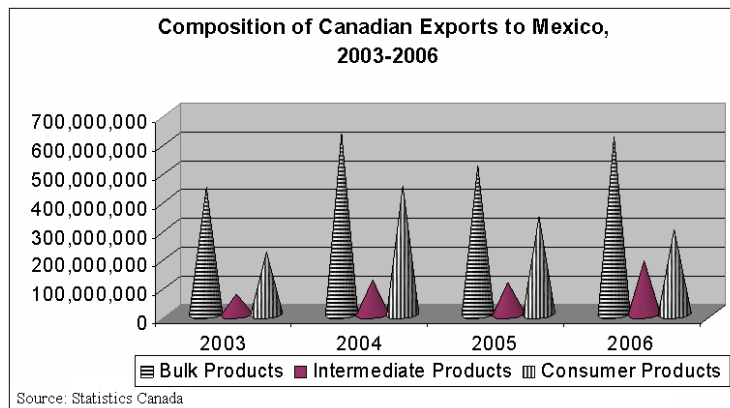
The Mexican food market is estimated to be worth \$153 billion, of which imports represented roughly \$20 billion. The United States is the largest food exporter to Mexico and accounts for 70 percent of all food imports. This is followed by Chile at 14 percent and Canada at 6 percent. Canada's share of the Mexican food import market in 2006 was approximately \$1.1 billion.

The expansion of the Mexican food imports will continue because of rising incomes and population growth. In 2006, Mexico's population was estimated at 107.5 million, with an annual growth rate of 1.16 percentⁱ. This compares with the Canadian population of 33.1 million and a growth rate of 0.88 percent. In terms of demographic profile, the Mexican population is young, with over 30.6 percent of the population under the age of 14 and only 5.8 percent over 65 years oldⁱⁱ. Even with decreasing family size, the Mexican population will continue to grow for the next couple of decades because the juvenile cohort is so large.

Economic growth in Mexico is more erratic than in Canada, but on average it is comparable or higher. The Mexican economy has had difficult adjustments to Chinese competition and to currency exchange rate changes. When population and income growth are combined, the demand for food imports in Mexico is increasing much faster than Canada's domestic food market.

Food product exports can be divided into three groups: bulk commodities, intermediate goods and consumer products. Figure 1 presents the values of each product category exported to Mexico. In 2006, bulk commodities account for 56 percent of total agri-food export value, intermediate goods represent 17 percent of sales and consumer goods earn 27 percent of total agri-food export revenues with Mexico.

Figure 1 Shares of Canadian Agri-food Exports to Mexico

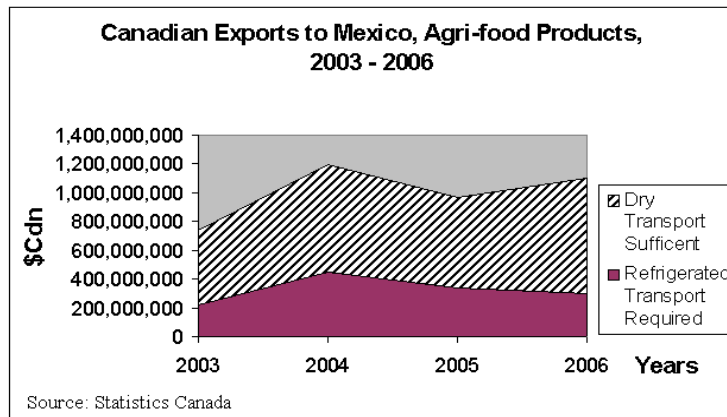


Bulk commodities are mainly grains and oilseeds. These commodities have few value-added services except cleaning, classification and storage. Intermediate goods include such diverse products as breeding stock, tobacco and raw hides. Intermediate value-added products are used as inputs to achieve higher value-added finished goods in Mexico. Consumer goods are generally ready to consume and contain the most value-added services.

The shares of these product classifications change from year to year. Since 2003, the share of intermediate goods has been growing steadily relative to consumer goods, but this time period is too short to identify trends. For example, a significant increase in tobacco exports occurred in 2006. This one product increased intermediate goods exports by 75 percent. At the same time, consumer product exports are recovering from the impact of BSE that cut off beef exports to Mexico. These data show up after 2004. Such events illustrate the sensitivity of trade data to unexpected changes in product mix.

The gross shares of dry and refrigerated agri-food exports to Mexico are presented in Figure 2. The share of agri-food exports transported in refrigerated vehicles varies between 27 and 37 percent of total exports in recent years.

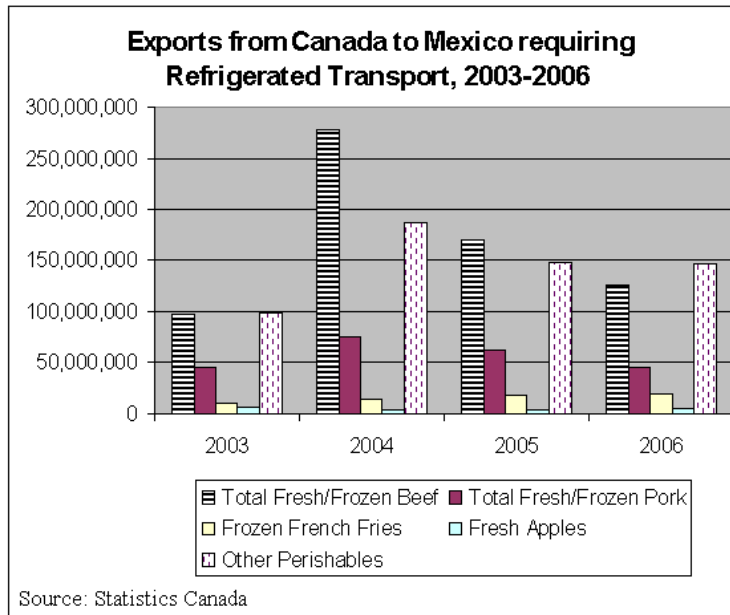
Figure 2 Shares of Agri-food Exports by Transport Requirements



Since the removal of customs tariffs under the North American Free Trade Agreement (NAFTA), value-added food products are exported to Mexico from every region of Canada. The four major perishable food product exports from Canada to Mexico are beef, pork, frozen French fried potatoes and apples. Figure 3 illustrates the export values of these four products and the combined value of all others. Beef is the largest single food product export category and continues

to dominate Canadian exports despite the BSE problem. Pork has followed a trend similar to beef, but with less variation.

Figure 3 Canadian Agri-food Exports to Mexico, requiring Refrigerated Transport, 2003-2006



The residual category “other perishables” accounts for about one quarter of value-added food exports. These other perishables comprise a wide range of value-added agri-food products. During the course of this research interviews were conducted with exporters of frozen pizzas, English muffins, brownies, tarts, processed cod, fresh salmon, and frozen hors d'oeuvres, as well as the major perishable commodity suppliers.

TRANSPORTATION AND LOGISTICS SUPPLY OPTIONS

The choice of transportation to use for exporting food products to Mexico depends on product shelf-life, shipment size and service

availability. The list below summarizes in general terms the options for Canadian food exporters.

- Fresh Products: 1 - 9 day shelf-life
 - Air Cargo – 100 kgs to 2 tonnes
- Fresh Products: 10 - 60 day shelf-life
 - Refrigerated Tractor-trailers – 20 tonnes
 - Refrigerated Less-than-truckload – up to 10 tonnes
- Frozen Products: 2 - 24 month shelf-life
 - Refrigerated Tractor-trailers – 20 tonnes
 - Refrigerated Railcars – 85 tonnes
 - Refrigerated Intermodal Containers – 20 tonnes

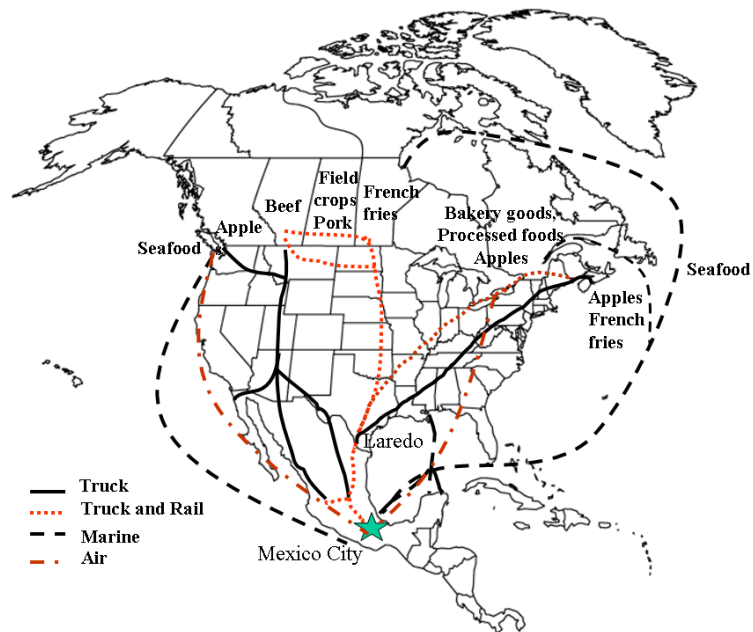
If the product has a very short shelf-life, then air shipment is the only choice. Typically, air shipments would range from 100 kilograms to 1 tonne.

Fresh chilled products (not frozen) with a shelf-life from 10 to 60 days use refrigerated truck transport. These shipments are normally in full truckloads of approximately 20 tonnes. Refrigerated less-than-truckload (LTL) shipments are generally unavailable.

Frozen products have the most transportation choices because they enjoy the longest shelf-life (up to 24 months) in transit and storage. Frozen goods are shipped in refrigerated trucks, railcars and intermodal sea containers. No Canadian railway offers refrigerated intermodal container services from Canada to Mexico.

Figure 4 presents the major transportation routes to Mexico. Although Mexico has many border crossings, Laredo dominates all entry points for non-grain deliveries to the principal markets in Mexico. Rail and truck compete mainly in the mid-continent corridor to source frozen beef, pork and French fries out of the Canadian prairies and for potato products out Atlantic Canada. Processed and perishable products like apples are moved exclusively by truck, which also dominates the east and west coast routes. Marine transport competes with the railways for field crops and some frozen product.

Figure 4 Major Transportation Routes for Food Products Shipments from Canada to Mexico



Air:

Fresh food products are carried in intermodal air containers and in loose cargo of 100 to 150 kilograms. The air containers are the LD2 (0.95 tonne) and the LD3 (1.25 tonne). Loose cargo is shipped in the belly space of narrow-body airplanes, like the Boeing 737 and Airbus 320. Air freight containers are only carried on wide-body passenger aircraft or on dedicated cargo airplanes. Canada has only a few major gateways for containerized air freight to Mexico. At this time, no dedicated air cargo freighters serve the Canada-Mexico market. Containerized air cargo to Mexico City is available on passenger flights at Vancouver, Toronto and Montreal. Fresh fish is one of the

few perishable food products that are shipped regularly via air from Canada to Mexico.

Trucks:

Most Canadian food exporters use truckload shipments to serve the Mexican market. Trucks cost about 30 percent more than railcars on a per tonne-kilometer basis, but the transit time is shorter and the truckload unit size is convenient for inventory control and warehousing.

Refrigerated Canadian truck trailers can be interchanged with Mexican truckers that bring the trailers into the interior of Mexico, and return the trailers to the Canadian carriers at the border. Alternatively, Canadian shipments can be transloaded at the U.S.-Mexican border directly into a Mexican trailer, or the goods can be placed in a refrigerated storage warehouse then re-loaded into a Mexican truck when one is available.

The trucking market is very competitive and dynamic. Exporters face a sellers' market in trucking services from September to December, and a buyers' market after Christmas. Canadian owned and operated refrigerated trucks have some advantages and are generally preferred. American trucks are permitted to pick up Canadian food products and carry them in-bond through the U.S. to the Mexican border crossings, but the cost of bonding has to be considered. The bond is like an insurance policy. The carriers have to pay about \$1,500 per year to carry a \$50,000 bond on their equipment. Unless the U.S. trucks are carrying a lot of Canadian volume, it may not be economically attractive for them to obtain the bonding insurance.

Several carriers offer LTL shipments for dry goods (non-refrigerated) from points in Canada to Laredo. During the course of this research only one trucking company was identified that offers LTL refrigerated shipping to Mexico. In this case, the carrier demands a minimum 15 tonne shipment that is not really an LTL service.

Rail:

The rail systems in North America have a predominantly east/west orientation. Both CN Rail and CP Rail have U.S. subsidiaries and agreements with connecting railways to deliver railcars to Mexico.

Nevertheless, the routing is not direct and interlining railcars adds to the total transit time. CP Rail hands off refrigerated railcars from western Canada to the U.S. railways for delivery to eastern Mexico at their St. Paul, MN interchange. Railcars from eastern Canada are handed off at Chicago. CN Rail can interline via its Illinois Central subsidiary with the Kansas City Southern for delivery to Mexico City. Both Canadian railways have agreements with the BN-Santa Fe and the UP railways for deliveries to Mexico.

Refrigerated railcars can be interlined with the Mexican railways for delivery to warehouses in Mexico City and other locations, but the ability to schedule through traffic depends on the commodity. Frozen French fries can be delivered by rail directly to Mexican receivers. However, meat products must be inspected at the Mexican border and no crossing has a rail-based meat inspection facility. Consequently, frozen meat shipments are unloaded at the border and moved to refrigerated warehouses. Subsequently, frozen beef and pork shipments are trucked to inspection stations and onward to their final destination in Mexico.

Marine Transport:

Some exporters have tried refrigerated marine containers, but none of the interviewed shippers use marine transport to eastern Mexico at the present time. The sea route is criticized as being slow and unreliable. Veracruz is the main Mexican container port on the Gulf of Mexico.

During the outbreak of BSE, when beef was not allowed to cross the United States, Canadian beef was shipped in refrigerated marine containers to Mexico via the west coast. Exporters have returned to refrigerated trucks and railcars now that passage through the U.S. is permitted again. Refrigerated container loads of frozen chicken and pork are exported through the Port of Vancouver to Manzanillo, Mexico which is the largest container port on the Pacific coast. The freight forwarder who arranges these shipments reported that the marine route offers a freight benefit of 10 to 15 percent relative to truck rates.

Marine transport is used in the Gulf of Mexico to serve southern Mexico. A rail ferry that operates from Mobile, Alabama to Coatzacoalcos, Mexico takes about 4 days. This route is used by one

of the frozen French fry importers to handle about 20 percent of their shipments.

COLD CHAIN CHALLENGES

Interview respondents outlined a number of challenges concerning the cold chain from Canada to Mexico.

Maintaining climate control:

The quality of the cold chain is a function of technical capacity and management. Fresh products depend on the speed of trucks and the driver to manage the refrigeration system. Aging in-transit benefits beef, but not pork which is always tender and must be processed or used within 12 days of shipping.

The speed of a chemical reaction doubles with every 10°C increase in temperatures. This is why holding the temperature of fresh foods close to zero extends their shelf-life. Fresh products may spoil quickly if the refrigeration unit malfunctions or runs out of fuel. Truck drivers are expected to inspect and maintain the refrigeration unit every couple of hours.

The success of the cold chain depends on maintaining the temperature of the product within a very narrow range during transit through the marketing channel. Frozen products may withstand breaks in the cold chain better than fresh products, but shelf-life and quality are generally reduced by any unanticipated temperature increases. Consequently, shippers and carriers are cautious in choosing partners.

***Respondent 3: Carrier – Truck** [Railway X] will ensure that the container is refueled and they will ensure that the setting is appropriate for the temperature, and so on. But, with [Railway Y], I would not interchange our reefers at this point. We don't know their procedures; we don't know what they are going to do.*

The cold chain of the Mexican distribution system can also leave a lot to be desired. A refrigerated delivery truck that makes 10 deliveries over the course of its route is continually opening and closing its doors to ambient temperatures about 25°C. Under these conditions the refrigeration unit has a hard time maintaining climate control.

Failure of the cold chain in Mexico is not just a technical issue.

Respondent 18: Importer of Frozen Products *The classic is the store manager, who to save energy, turns off all the electricity in the store every night and goes home. Don't turn off the freezers please!*

Relationships with carriers:

Exporters develop relationships with carriers they can rely on. It takes only one break in the cold chain to destroy a high quality perishable product. Consequently, shippers are often reluctant to embrace offers of low rates from unknown carriers

Respondent 13: Exporter of Meat Products *There's a lot of guys that are fly-by-night. You're dealing with sensitive products that need temperature control and gas is expensive. They'll turn off the reefers, which has happened even to the best guys. Refrigeration is expensive and to keep the reefer going is costly. So, they shut it off for five, six, seven hours to save some money. Nobody knows the difference because they contract some of the work out. It's not necessarily their trucks they are running. It's dependent on a guy from "god-knows-where" and he's free for a week and needs a load.*

Frozen vs. fresh:

Frozen goods are more forgiving of equipment failure in transit than are shipments of fresh chilled food products. An insulated railcar will keep the product frozen for a considerable period after the refrigeration unit shuts down. The railways have a good record for frozen shipments, but will not accept fresh products because they cannot guarantee quality.

Respondent 16: Carrier – Rail *We can move frozen product to and from Mexico but not refrigerated - because of the transit times and the equipment maintenance is very, very difficult. The temperature control on the equipment has to be constantly checked on the route. We are playing with other partners. There's at least two or three railroads involved. The risk [for fresh products] is too high.*

Inspection of meat at the border:

The inspection of meat at the border is necessary for both truck and rail shipments. Truck shipments are easier to handle because they can pull up to the inspection facility's dock. As described earlier, rail

shipments lack meat inspection facilities so the meat has to be loaded from the railcar and stored in a refrigerated warehouse before movement to the inspection facilities. Rail shipments of meat incur extra unloading/re-loading and warehousing charges.

Meat products have a break in the cold chain caused by border inspection, but any refrigerated product may be inspected at the border. Refrigerated products are more of a concern than frozen.

Respondent 2: Exporter of Meat Products *With frozen, you still have the option – if something goes wrong with the paper – to put the load into cold storage and work on [the] papers, whereas with the fresh, you don't have that option. [For fresh], you are very much stressed out or things could go really wrong.*

Loading for the border:

Some exporters may wish to load the truck from the floor up to avoid the cost and weight of pallets. However, If there is a border inspection, the break in the cold chain could make this a costly decision for perishable products.

Respondent18: Importer of Frozen Products *When you get stopped in [Mexican] Customs, the inspector is going to say, "I need you to unload that trailer." And if you floor load it, it's going to take you a whole day to get your frozen product out and then back in, right? But if it's on a palette, the forklift comes, brings it out, the inspector sees it, okay, put it back in. Your cold chain was more or less intact and you're happy you didn't lose all your product. So, put it on palettes.*

Loading for handling:

Better quality of pallets and packaging are needed for shipping perishable products to Mexico. Transloaded cargo is handled more and the refrigerated environment picks up moisture from the atmosphere that can weaken packaging materials.

Respondent 11: Exporter of Fresh Chilled Products *Make sure packaging materials are good quality because in the end, cheap is expensive. We've seen that. We told one packer, "Listen, you've got to beef these boxes up, with corrugated cardboard because it's refrigerated, it's damp and the boxes will sag." He's trying to save a*

dollar but you don't with cheap pallets or packaging. Quality packaging is very important so it withstands the shipping, especially the transloading.

Quality:

The average quality of the Mexican cold chain is lower than in Canada or the U.S., but the outlook is encouraging. The universal impression inferred from study respondents in Mexico is that the cold chain has come a long way and is improving. As one respondent said, referring to a Mexican frozen warehouse and distribution firm, "They have excellent service, but it is not very cheap."

Refrigerated railcars:

Refrigerated railcar service to Mexico is generally difficult to obtain everywhere in Canada. Refrigerated equipment is expensive and the railways are reluctant to purchase an additional vehicle unless they can be assured it will be employed. The railways actively encourage large shippers to purchase or lease refrigerated railcars to carry their goods. The railways manage their own fleets aggressively.

***Respondent 16: Carrier – Rail** From a railroad perspective, we don't like to let refrigerated railcars take a long cycle time because they're not earning money for us. We actually sit on top of those cars with a whip and push them down. We'll ride them because it costs us a lot of money to have them sitting on someone else's lines. It's a huge investment. The railroads don't like to have any cars idle but if we are going to have any equipment idle we don't want it to be refrigerated cars.*

Refrigerated trucks have the advantage of triangulation in competing with the railway. Whereas a railcar is confined to its tracks, and more or less retraces its route, a truck can run empty from say, Laredo, Texas to Arizona to pick up a northbound load of fresh produce. If the railway costs are not assisted by a backhaul load, they are forced to seek the round-trip costs from Canadian exporters. The railways maximum charges are constrained however by the rates offered to shippers by refrigerated trucks.

The thin margins for the railways leave scant incentives to improve service to the Mexican market. Significant volumes of refrigerated

products that could be moved by rail from Mexico may exist, but Mexican shippers still remember the problems of the formerly state-owned Mexican railways far too vividly. There is a lack of trust in the Mexican rail system that is ingrained and difficult to change, despite the privatization and improvements that have occurred.

Exporters to Mexico have to compete for refrigerated railcars with the more lucrative routes in Canada. If the railway can obtain quicker cycle times for its equipment on east/west routes, then it is difficult to convince them to divert their cars to north/south routes.

Refrigerated equipment is more delicate, more valuable and more management intensive than dry vans and boxcars. The purchase price of a refrigerated intermodal container or truck trailer is \$65,000 to \$70,000 more than a dry van. If a dry van has a small leak, it is easier to fix than a break in the insulated envelope of a refrigerated trailer. Moreover, a leak in a dry van may do little damage to the cargo, while a loss of refrigeration is almost guaranteed to affect the quality of perishable products. The delicate nature of refrigerated equipment and its costs are the prime reasons that the railways are not interested in providing refrigerated intermodal container services to Mexico.

CONCLUSIONS

The success of the value-added food sector is premised on a reliable cold chain for transport and distribution. The cold chain to Mexico has more opportunities for breaks to occur than Canada-U.S. trade. Every time there is inspection, transshipment or equipment interline, the integrity of the cold chain is tested.

Refrigerated trucks are the most widely used mode of transport for the export of fresh chilled and frozen food products to Mexico. Air transport is used for highly perishable, luxury food products and the transport of samples. Refrigerated railway boxcars are used only when the product is frozen and the volume is sufficient to utilize their capacity. Marine transport has a minor role in frozen food shipments.

Refrigerated product trade between Canada and Mexico is very unbalanced. This creates the problem of empty backhauls. The lack of northbound return loads is a key problem in using refrigerated railway boxcars. If Canadian shippers could partner with Mexican

shippers to balance refrigerated movements, freight costs for both parties could be reduced and the railways would show more interest in providing equipment.

A refrigerated railcar meat inspection facility at the U.S.-Mexico border could reduce the cost of shipping railway boxcars of frozen meat to Mexico. A study should be undertaken to identify all the transportation stakeholders in each country to examine flows of beef and pork from Canada and the United States to Mexico and to determine whether the cost/benefit of a refrigerated railcar inspection facility would support such investment.

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ⁱ http://www.indexmundi.com/mexico/demographics_profile.html

ⁱⁱ In Canada the population is aging faster with 17.6 percent of its population under 14 and 13.3 percent over 65.