

CANADIAN LOGISTICS SERVICES: MEASUREMENT ISSUES AND OPPORTUNITIES

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Introduction

Logistics management has grown from relative obscurity to become the lifeblood of modern business and the supply chain now represents the channel along which businesses compete in a global economy. With an economy based on trade, Chow and Gill (2011) note that Canada is even more highly dependent on the efficient movement of products within, to and from the country. Despite this prominence, statistical agencies continue to grapple with measures of logistics - the management and coordination of transport, inventory, facilitation, compliance mandates and related services along the supply chain. Developing measures is a challenge since it is not a sector *per se* but rather a bundle of activities dispersed among several industries.

This paper describes the challenge and opportunities in measuring logistics service activities. It begins with a review of the underlying factors - regulatory reform, trade liberalization and technological advancement - that have allowed outsourcing to more specialized logistics providers. Next, it outlines the measurement challenge of defining logistics using standard classifications. The paper then reviews efforts to date at Statistics Canada in providing relevant data on logistics services, including a profile of the size and composition of a Canadian industry. We conclude by identifying an opportunity to provide data that describe the use of advanced technologies in transportation and distribution service industries.

The emergence of logistics service providers

While cost-efficient physical movement and delivery has always been of concern to businesses, viewing such activities in an integrated manner is more recent (Ballou, 2007). Historically, it was more common to focus on independent activities such as transportation, purchasing or storage and the structure of most businesses reflected this with a series of independent management areas having little emphasis on an integrated systems or total cost approach (Southern, 2011).

Physical distribution (outbound logistics) and materials management (inbound logistics) emerged initially as separate concepts and business logistics focused on coordinating activities within management areas, rather than between functions or even companies (Ballou, 2007; Hesse & Rodrigue, 2004). Efforts to coordinate multiple functions related to the flow of goods would come to be known as integrated logistics or supply chain management. It was the confluence of three factors that enabled these efforts.

Regulatory reform

Historically, transportation markets were heavily regulated in the United States (U.S.). The Interstate Commerce Commission set conditions of entry and exit, applied rate structures and enforced rules of operations for railways. For airlines, the Civil Aeronautics Board determined new route allocation, rates and levels of in-flight service. Some argue that the deteriorating economic performance of carriers was an unintended consequence of this regulation (Lakshmanan & Anderson, 1999; Winston, 2013). In the U.S., the 1978 *Airline Deregulation Act* served to initiate regulatory reforms both across modes (e.g. 1980 U.S. *Staggers Rail Act*) and in other countries.

Although the 1967 *National Transportation Act* permitted limited competition between modes in Canada, markets remained subject to entry restrictions and rate setting. Since Canadian and American carriers competed directly in trans-border markets, the need for a more level playing field became apparent after American deregulation. A federal policy paper "Freedom to Move" (Transport

Canada, 1985) signalled the direction that reform would take in subsequent legislation: The 1987 *National Transportation Act* and 1987 *Motor Vehicle Transport Act* as well as amendments to the existing *Railway Act*. These reforms ushered in a period of restructuring within Canadian transportation markets (Brooks, 2008).

Trade liberalization

The ability to move goods efficiently is a prerequisite for enhanced trade and regulatory reform preceded efforts to reduce trade barriers. The initial impact of globalization on Canada was regional integration (i.e. Canada-U.S. Free Trade Agreement, FTA) and thus typically involved the surface modes (Gu & Sawchuk, 2006). Trucking markets were highly fragmented while, conversely, rail markets were more concentrated (Brooks, 2008). The 1988 FTA did not address transportation issues since the U.S. was still implementing a broad program of deregulation and Canada was just embarking on one.

Soon after, negotiations commenced to extend free trade to Mexico under the North American Free Trade Agreement (NAFTA). It served to reduce trade barriers by phasing out all remaining Canada - U.S. tariffs by 1998. This opened up markets for international point-to-point traffic and Monteiro (2011) feels that Canadian carriers were successful in attempts to expand market share. However, Anderson and Brown (2012) found higher than expected line-haul costs on cross-border trucking and attribute this to difficulties in finding back-hauls as domestic cabotage restrictions remained.

Nevertheless, NAFTA permitted carriers to operate across borders which influenced the distribution strategies of shippers on both sides. Canada has since entered into nine additional free trade agreements and is currently negotiating twelve others², including a Comprehensive Economic and Trade Agreement (CETA) with the European Union, a region with more than 500 million consumers and a GDP of \$17 trillion. The growing importance of international trade has further boosted the expansion of global supply chains and the importance of logistics services.³

Technological advancement

Innovations in business practices such as logistics were facilitated by Information and communications technologies (ICTs) (Hesse & Rodrigue, 2004; Ouellet, 2010).⁴ For instance, Efficient Consumer Response (ECR) retailing and Just-in-Time (JIT) production required Electronic Data Interchange (EDI). Digital technologies further spurred innovation in material handling such as bar-coding and Radio Frequency Identification (RFID) for Automated Storage and Retrieval Systems (AS/RS). Industry Canada (2011) notes that businesses in the courier and trucking industries are using leading edge mobile devices and tracking systems for delivery.

As part of Warehouse Management Systems (WMS), businesses in distribution and storage are using voice recognition for picking, packaging and order processing. Similarly, Advanced Planning and Scheduling (APS) has allowed marine and air carriers to link and integrate their information systems with both customs authorities and reservation systems. And geomatics technologies such as Geographic Information Systems (GIS) and Global Positioning Systems (GPS) are used to develop fleet optimization and fuel rationalization tools for Transportation Management Systems (TMS).

As these technological advances “pushed” the availability of specialized logistics practices, global value chains and factory-less goods productions “pulled” their requirement. The confluence of regulatory reforms and trade liberalization with this rapid diffusion of electronic business processes enabled many large companies to adopt supply chain management and to outsource service inputs (Brooks, 2008). Outsourcing was facilitated by the emergence of specialized logistics services ranging from delivery, storage, light assembly and packaging to inventory management, freight forwarding, custom brokering and equipment rental as well as management consulting.⁵

The measurement challenge

Definitions

Service activities (e.g. delivery) can be conducted in-house or outsourced to a separate company. Own-account or in-house logistics are performed by manufacturers, retailers, and other businesses. Although there may be a separate profit or cost centre, statistical agencies classify a company to an industry according to its main business. So, while a unit within a manufacturing firm may provide logistics services, the primary activity of the company is considered manufacturing and it is classified as such (see *Classifications*). Outsourced logistics are the provision of services such as delivery, storage and inventory management by a separate company.

A third party logistics (3PL) provider typically refers to the tactical outsourcing of one or more related logistics activities to a specialized provider (Marasco, 2007). In general, 3PL's can either be asset-based companies that handle the goods of other companies or provide non-asset based services such as freight forwarding. The term fourth party logistics (4PL) provider refers to a company that manages the entire supply chain for another company. Generally, a 4PL may not own any physical assets but rather provides more strategic management, often directing a series of more specialized 3PL providers.

Classifications

Current classification systems present some challenges for the measurement of logistics services. The North American Industry Classification System (NAICS), used by Canada, Mexico and the U.S. to provide a common industrial structure, classifies business establishments to an industry according to their primary activity.⁶ In cases of multiple activities, the determination is based on value added (value of outputs minus cost of inputs) with the largest considered the principal activity. The measurement challenge is that logistics services do not constitute a sector but rather a bundle of activities dispersed among several industries (Bess & McKeown, 1998).⁷

Logistics service activities may be undertaken in-house or contracted out to more specialized providers. Some own-account logistics activities are found in establishments classified to Agriculture & Forestry (NAICS 11), Mining & Energy (21), Manufacturing (31-33) and Distributive Trades (41, 44-45). Many out-sourced logistic service providers are classified to the Transportation and warehousing sector (48-49). It contains asset-based companies that deliver services such as trucking (484), couriers (491) and warehousing (493) as well as those offering ancillary services, including non-asset based service providers (e.g. Marine shipping agents in 488).⁸

During 2012, Transportation and warehousing (48-49) accounted for 4.2% of GDP in Canada, more than Agriculture, forestry and fishing industries combined and just slightly less than Retail trade. However, transportation is also a cost that must be incurred to complete almost any market transaction. For example, of the \$457.6 billion of Canadian exports in 2012, almost three quarters went to the U.S. by truck or rail. Indeed, Winston (2013) feels this sector is so intertwined with virtually all other sectors of the economy that it is vital for policy makers to assess its performance. The availability of measures and data is a prerequisite for such assessments.

Measurement of Canadian logistics services

A review

Most data available on logistics activities tends to be performance-based metrics such as fluidity measures (e.g. units per transaction, inventory turnover rates). Some data are collected for one-time studies. For example, Gregory and Kwiatkowski (2011) used data from a selected sample of trucking carriers with positional tracking devices to examine variances in travel time between major city-pairs. Transport Canada has also been monitoring the supply chain performance for containers imported through North American gateway ports in order to provide metrics on direct-to-rail/truck movements and port dwell times (Gregory, 2013).

Other data are assembled for comparisons across countries. For example, based on a survey of freight forwarders, the World Bank's Logistics Performance Index (LPI) profiles 155 countries using ordinal rankings of different logistics dimensions such as infrastructure, customs clearance and timeliness. Chow (2013) used the LPI to assess Canada's freight system and concluded that freight movements are highly competitive with those of the U.S. While such studies and indices provide vital metrics, statistical agencies must produce reliable, national estimates of more conventional economic measures (e.g. output, value-added) based on agreed upon definitions.

Bess and McKeown (1998) examined the Monthly Survey of Manufacturing's inventory-to-sales ratio as a hallmark of JIT production. It declined from a post-1982 recession high of 2.2 to below 1.4 by 1993 (Figure 1). The related inventory turnover rate implies that the frequency with which manufacturers replenished their inventories went from an average of about 6 times per year to almost 9. This rate is an aggregation of all establishments which may mask differences between manufacturers of heavy machinery (e.g. airplanes), having a lower turnover rate, and those producing less expensive products (e.g. auto-parts), having a relatively higher rate.

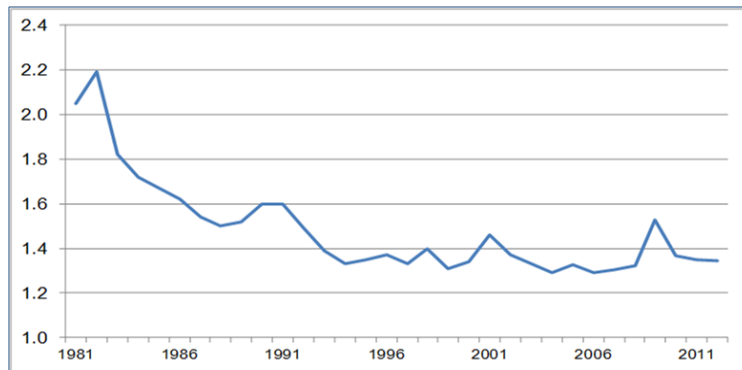


Figure 1: Inventory-to-Sales Ratio, Manufacturers (NAICS 31-39)
Source: CANSIM Tables 304-0001 (1981 to 1999) and 304-0014 (2000 to 2012)

Extending the series to 2012 illustrates how the ratio spikes upward as inventories tend to build during recessionary periods. However, the trend has remained somewhat flat below 1.4 into the 2000s. This does not necessarily imply that efficiency improvements in inventory management have subsided. Rather, it can be hypothesized that it may reflect a continued decline in depth of inventories (i.e. higher turnover rates per stock keeping unit or sku) but a corresponding increase in the breadth of inventories (i.e. more sku).⁹

Most Statistics Canada efforts to measure logistics involve activity-related surveys of certain industries. For instance, the 2007 Survey of Advanced Technology (SAT) included questions on business practices linked to supply chains. Almost one-third (31.8%) of manufacturing establishments (NAICS 31-33) used an automated material handling process such as part identification (e.g. bar coding) and RFID for tracking. It also found that over two-thirds (64.9%) of Canadian manufacturers used one or more supply chain business practices such as APS or WMS.

The 2007 Survey of Electronic Commerce and Technology (SECT) measured the use of Internet-based systems to manage logistics. Ouellet (2010) reported that 11% of private sector enterprises used an e-business process for inventory management and/or to organize deliveries to customers or from suppliers. It was higher for larger enterprises and those classified to Manufacturing (18%), Wholesale (19%) and Retail (22%). For enterprises integrating e-commerce and logistics, many identified better coordination with customers and suppliers (65%) as a benefit, more so than reducing costs (51%).

A redesigned and renamed Survey of Digital Technology and Internet Use was conducted in 2012. Compared to all private sector enterprises, relatively more classified to Manufacturing, Wholesale, and Warehousing & storage industries used Electronic Data Interchange (EDI), Customer/Supplier Relationship Management (CRM) or Enterprise Resource Planning (ERP) software (Figure 2). As anticipated, larger enterprises were more likely to report using CRM (41%) or ERP (35%) software. The sample size was insufficient to estimate by size and type of enterprise.

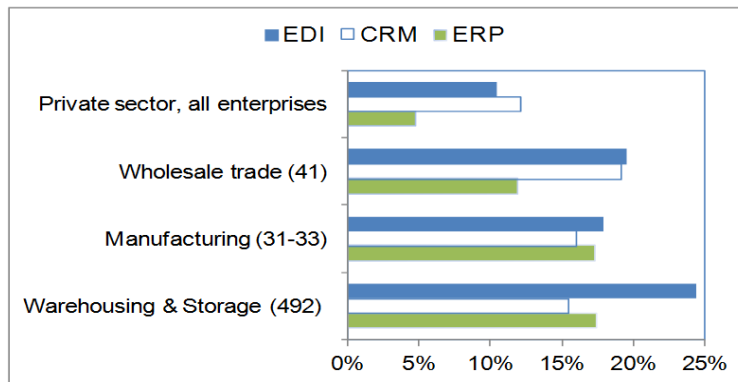


Figure 2: Use of ICT technologies by NAICS enterprises, 2012
Source: Survey of digital Technology and Internet Use, 2012

In 2009, the Survey of Innovation and Business Strategy (SIBS) gathered data on technology use, process innovation, and business strategies from a sample of enterprises across 67 NAICS industries. “Distribution and logistics” was one of 15 business activities for which a series of questions were asked on if, how and where business enterprises perform, invest and improve such activities. For example, one question asked respondents to indicate which business activities were undertaken domestically or outside of Canada and, for each, if they were done within the enterprise or contracted out.

Figure 3 compares the rate at which business activities performed in Canada were outsourced by manufacturers, excluding legal services which were contracted out by almost one half of manufacturers. Among business enterprises which reported performing these business activities in Canada, almost one in five (19.8%) reported contracting out Distribution and logistics activities in 2009. This was similar to the proportion contracting out ICT as well as Engineering and technical services, both traditionally considered specialized activities outside the core competency of manufacturers.

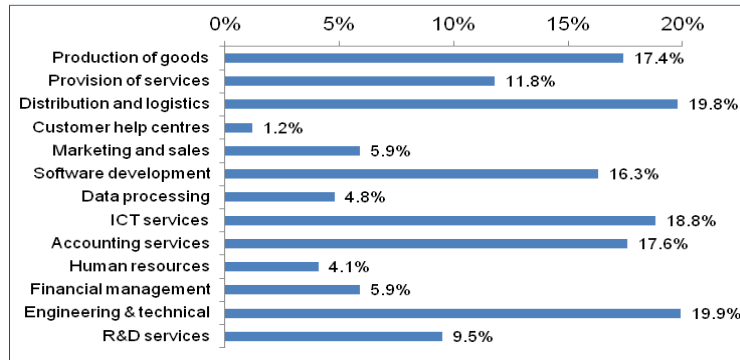


Figure 3: Business activities performed in Canada and outsourced, Canadian manufacturing enterprises (NAICS 31-33), 2009
Source: Survey of Innovation and Business Strategy, 2009

Statistics Canada has just starting to release data from the 2012 SIBS. From 2009 to 2012, there was a 20% increase in the proportion of business enterprises in Transportation and warehousing that reported implementing an organizational innovation (i.e. business practice, method of organizing work or external relations) that had not been used by the enterprise during the previous 3 years (Statistics Canada, 2014, CANSIM 358-0221). This was twice the increase in the rate of organizational innovation as reported by business enterprises in all surveyed industries (10%) over the same period.

A profile

Without common definitions, it is difficult to determine what to include in profiling Canadian logistics services providers. Merilovich and McKeown (2012) opted to use self-reported activity descriptions from two sources. First, member companies from *Supply Chain and Logistics Canada*¹⁰ (SCL) were included if they self-reported as either a 3PL or 4PL. Second, companies were selected from Statistics Canada's Business Register (BR) if one of their three largest revenue sources included the term "logistics" or "supply chain management". A total of 855 Canadian businesses were selected to profile logistic service providers from 2001 to 2010 (Table 1).

Table 1: Characteristics of selected logistics providers, 2008

	SCL	BR	Total
<i>Number of Companies</i>	164	604	768
<i>Average revenue ('000s)</i>	\$57,211	\$6,498	\$17,403
<i>Median revenue ('000s)</i>	\$12,317	\$537	\$1,238
<i>Total revenue ('000s)</i>	\$9,497,052	\$3,938,098	\$13,435,150

Source: Statistics Canada Business Register and SCL Canada

However, not all companies were active for the entire study period; in 2008 for example, 768 were active. There was little overlap in companies selected with just 3% common to both sources in 2008 as the BR was able to identify more small- and medium-sized providers. Selected companies were aggregated into NAICS groups and profiled using information contained in the Business Register (Figure 4).¹¹

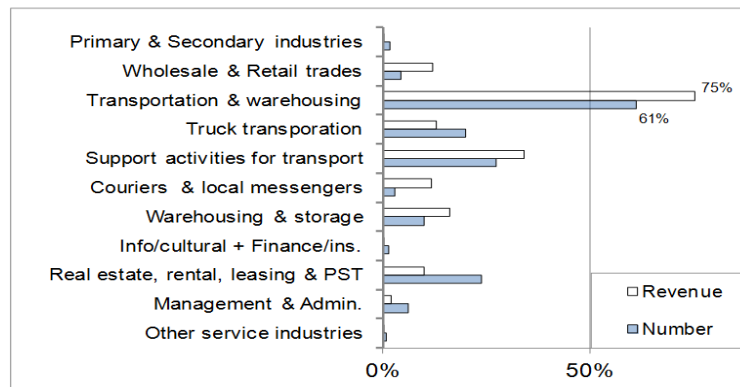


Figure 4: Selected logistics service provides by NAICS, 2010
Source: Statistics Canada Business Register and SCL Canada

By 2010, roughly 85% of the selected companies selected were from Transportation and warehousing (61%) or Professional, scientific and technical services (24%). Of the 450 increase in the number selected during the 10 year period, over one quarter (121) were classified to

Support Activities for Transportation (NAICS 488)¹². Annual total revenues increased from just under \$8 billion in 2001 to over \$12 billion in 2010. Of the 2010 total, NAICS 48-49 accounted for three quarters (75%) of the reported revenues with sub-sector 488 having the largest share (46%). Companies assigned to Warehousing and storage (493)¹³ accounted for 16% of total revenues by 2010.

Summary

The supply chain now represents the channel along which businesses compete in a global economy. Deregulation, trade liberalization and the rapid diffusion of ICT technologies enabled businesses to outsource logistic activities to more specialized providers. Despite this prominence, statistical agencies are somewhat challenged in measuring these activities. Although some consideration of a logistics services industry was made during revisions to the Standard Industry Classification in the 1990s, the measurement challenge remains in that logistics services do not represent a sector *per se* but rather a bundle of activities dispersed among several NAICS industries.

Efforts at Statistics Canada to provide relevant data on logistics service activities have tended to focus on specific business practices and technologies in certain industries. For example, the Survey of Innovation and Business Strategy included questions on “Distribution and logistics” as one of about fifteen business activities. Statistics Canada is currently conducting a feasibility study for a 2014 Survey of Advanced Technologies. While this survey previously focussed on the manufacturing industries, it is now apparent that advanced technologies are not just important in making products but also in storing, assembling, packaging, managing and delivering them.

The study will determine whether to expand survey coverage to selected service providers including those classified to the Transportation and warehousing (48-49) and the Professional, scientific and technical services industries (54). And based on a 2010 profile of selected logistics providers, companies classified to these sectors accounted for more than four-fifths of both those selected

(84%) and annual total revenue (81%). With integrated logistics services, measuring freight movement is not only a question of quantifying *what* and *where* but also *how* and by *whom*.¹⁴

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Endnotes

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² Free trade agreements were signed with Israel and Chile (1997), Costa Rica (2002), the European Free Trade Association and Peru (2009), Colombia (2011), Jordan (2012), Panama and Honduras (2013) while negotiations continue with the Ukraine, Trans-Pacific Partnership, Singapore, Morocco, Korea, Japan, India, Dominican Republic, Central American Four (CA4) and the Caribbean Community. Source: <http://www.international.gc.ca/trade-agreements-accords-commerciaux/agr-acc/fta-ale>

³ The value of international merchandise trade has increased in Canada from a combined (Exports + Imports) \$386 billion in 1993 to \$931 billion by 2012.

⁴ Also, containerization permitted lower volume flows with economies of scale by consolidating shipments in batch units (Hesse & Rodrigue, 2004).

⁵ Some companies such as *Amazon* have elected to set up their own distribution centres providing same or next day delivery of merchandise while others, including *Dell* and *Apple* computers, continue to out-source logistics services to third-party providers.

⁶ Economic statistics are produced either for the enterprise - the top of the business hierarchy with a complete set of financial statements - or for the establishment - the level at which accounting data required to measure production is available. At the location level, logistics activities would be more apparent and readily discernible.

⁷ Activities include transport & delivery, storage & warehousing, light assembly & packaging, inventory management & customer service, freight forwarding & custom brokering, equipment rental & leasing, and software & management consulting.

⁸ Some non-transport providers are found elsewhere including management consulting services (in 541) and Packaging and labelling (in 561).

⁹ As Hesse and Rodrigue (2004) note, inventories are increasingly in circulation and the concept of mobile inventories can blur the assessment of distribution costs.

¹⁰ SCL is a membership based organization that provides research, education and networking opportunities in order to learn more about Canadian logistics.

¹¹ Of the 855 companies selected, some were excluded from the profile to protect confidentiality. Also, classifications tend to be more accurate for those industries that are part of a regular survey program compared to those which are not.

¹² Comprised of establishments primarily engaged in providing services to other transportation (e.g. freight forwarders, marine shipping agents and custom brokers).

¹³ This sector "provides facilities to store goods for customers and ... a range of services often referred to as logistics ... labelling, breaking bulk, inventory control and management, light assembly, order entry and fulfillment, packaging, pick and pack, price marking and ticketing and transportation arrangement."

¹⁴ Hesse and Rodrigue (2004) note that world exports have grown faster than world production with freight flows characterized by lower volumes, higher frequency and longer average distances. As such, they assert that freight transport is likely to consume an increasing amount of energy and have a larger environmental impact.